BULLETIN No. 16. S. 25.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF SOILS.

CATALOGUE

OF THE

FIRST FOUR THOUSAND SAMPLES IN THE SOIL COLLECTION OF THE DIVISION OF SOILS.

BY

MILTON WHITNEY,
CHIEF OF DIVISION OF SOILS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1899.

BULLETIN No. 16. S. 25.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF SOILS.

CATALOGUE

OF THE

FIRST FOUR THOUSAND SAMPLES IN THE SOIL COLLECTION OF THE DIVISION OF SOILS.

BY

MILTON WHITNEY,
CHIEF OF DIVISION OF SOILS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1899.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF SOILS,
Washington, D. C., October 23, 1899.

SIR: For reasons set forth in the body of this report it seems advisable to publish a catalogue of the soil collection of the Division of Soils for the information of those who are interested in soil investigations.

The soil collection is under the immediate care of Miss Janette Steuart, of the Division of Soils, who has prepared the statistical part of this bulletin under my general supervision.

I recommend that this catalogue be published as Bulletin No. 16 of this Division.

Respectfully,

MILTON WHITNEY,
Chief of Division.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

CATALOGUE OF THE FIRST FOUR THOUSAND SAMPLES IN THE SOIL COLLECTION OF THE DIVISION OF SOILS.

INTRODUCTION.

During the past ten years a line of soil investigations has been carried on under the auspices of the Department of Agriculture, with particular reference to the physical properties of soils and their relation to crop production.

The soil collection was started in South Carolina while the writer was vice-director of the experiment station of that State, but a systematic line of investigation and of collection of soil samples was undertaken in connection with the Maryland Experiment Station and with the Johns Hopkins University in 1891.

As special agent of the Department of Agriculture in the Weather Bureau, the writer made an extensive study of the soil formations of Maryland and determined the relation of these soils to crops. This was an especially fine field for such work on account of the very large number of geological formations in the State, ranging from some of the oldest crystalline rocks through the whole geological sequence to the most recent river deposits. As a feature of this work a large number of soil samples was collected from Maryland and the results of the investigations were published in Bulletin No. 4 of the Weather Bureau, entitled The Physical Properties of Soils in their Relation to Moisture and Crop Production. The edition of this bulletin was long since exhausted.

In 1892 a very extensive soil collection was made from nearly all the States and Territories for exhibition at the Columbian Exposition in Chicago. This collection was under the general supervision of Prof. E. W. Hilgard, and, through an arrangement with him and with the local State collectors, duplicate samples were obtained from many of the States of soils which were supposed to represent the most important soil areas of the country.

In 1894 the scope of the work was greatly enlarged by the establishment of a Division of Soils in the Weather Bureau. In July, 1895, this was made an independent division in the Department of Agriculture and the appropriation and scope of the work were still further enlarged and extended.

With these facilities most of the important agricultural districts of the country have been visited by some one connected with the Division of Soils and the principal soil formations have been examined in the field and representative samples taken for the collection.

OBJECT OF PUBLISHING THE CATALOGUE.

The object of publishing this soil catalogue is, first of all, to call attention to the large number of samples at present in the possession of the Division of Soils. This collection represents a very large number of the geological formations of the country and many of the important agricultural districts. It is hoped that this will be a nucleus for a much more extensive and comprehensive soil collection, to be brought together at the national capital, which, if well arranged and thoroughly classified, with cross references as to the origin, physical properties, and agricultural values, will offer a valuable opportunity for soil investigations where dry samples of soil can be used.

It is hoped that by publishing this catalogue and showing what has already been accomplished in the matter of gathering together a collection of representative soil samples, individuals, organizations, and institutions may be induced to deposit collections as gifts or as loans, as in this way the facilities for soil investigations in Washington would be very largely increased. It is neither the purpose nor the desire of those in charge of the collection to increase the size by mere additional numbers of samples, but to have the collection contain truly representative samples which will illustrate all important phases of soil formations.

These special features and special collections are already receiving some attention. It is proposed to gather representative samples of loess from all known regions where it occurs. A very extensive and thorough collection of the truck soils of the eastern United States has already been made. A large and comprehensive collection of samples of tobacco soils has been made from all of the important tobacco districts. A special collection of representative wheat soils from all of the important wheat districts of the world is being planned. Other special collections of this kind are being considered which will show in more or less detail the physical or chemical peculiarities of characteristic soils which are of importance in agriculture.

One of the means of gathering samples of representative soils from foreign countries will probably be through the medium of exchange, and one of the objects of publishing this catalogue is the hope and expectation that such collections can be readily made through a system of exchange. It will be quite possible to furnish small samples of the representative soils of this country to institutions in exchange for special courtesies in furnishing representative samples from areas which are at present inaccessible to the agents of the Division of Soils, in order that the material at our disposal may be extended and made

more valuable. A number of institutions have already made use of this collection. Workers have been sent to Washington to become acquainted with the principal soil types, and in other cases representative samples have been furnished agricultural colleges and experiment stations for instruction and investigation.

In order to call attention still more forcibly to the importance and value of the soil collection and to extend this educational work, collections of representative soils are being put up in small glass bottles, arranged in boxes with 22 compartments in each. These sets are to be distributed to the agricultural colleges and experiment stations, with explanatory text regarding the origin, the chemical and physical peculiarities, and the agricultural value of the samples, together with a statement of the physical and chemical analysis of each.

HOW THE SAMPLES ARE COLLECTED.

It was early recognized that in order to be of comparative value the samples must be collected in a very systematic manner and according to certain general methods. A description of the methods followed by this Division was published in Bulletin No. 4, but as the edition of this bulletin is about exhausted, and as it may not be readily accessible to those who are interested in the catalogue herewith presented and who may wish to take samples for exchange purposes, the general principles of the method are here given.

As a rule it is necessary that the soils selected for the collection of this Division should represent large areas of land of uniform composition and of particular agricultural value. As, however, on account of the imperfections and limitations of our methods of investigation, all such work can have at present only comparative value, it is important in selecting samples to select also samples which show departures from the normal conditions, noting in great detail the effect of these areas on crops. Such samples often throw the most important light upon principles which might otherwise escape attention in the examination of the normal type. Furthermore, it is quite necessary to make a very complete statement as to the general and local physiographic relations of the locality from which the sample is derived.

Two soils may have precisely the same physical texture and chemical composition, and yet, from mere local peculiarities of drainage, exposure, or topographic features, the agricultural value of the soils may be very different. In many cases the conditions of environment may have a determining influence upon the relation of the soil to proper crop production. All such features should therefore be fully set forth in describing the sample and the locality from which it is derived.

In order that every sample may represent the area or a certain part of the area which it is desired to study or to illustrate, it must not be taken where there are modifications due to local conditions.

The following description of methods is taken from Bulletin No. 4 of this Division:

It is better, where possible, to take the samples from cultivated fields or fields which have been cultivated. The agricultural value of such land is known from the character of the crop it has produced, and this is a very important guide in the selection of typical soil samples. In the older agricultural regions of the Eastern United States, especially in the most fertile soil areas, there is little or no virgin land and often little woodland. Where the trees are allowed to grow, it frequently happens that it is on some spot or area which has been abandoned for some local cause or which has never been brought under cultivation because of its small agricultural value. A sample taken in such uncultivated spots would not represent the typical soil area of the locality, whereas soil which has been under cultivation carries a record in its crop yield and in the character of the crop produced, which is an important guide in the classification of the lands.

The samples should be taken inside a field, some distance away from houses, fences, roads, or trees. If plants are growing in the field, the sample should be taken midway between two plants. They should not be taken where the soil has been eroded nor where the soil has accumulated to an unusual depth by washing from above. It is doubtless better to take the samples from land which has not been freshly manured or where fertilizers have not been recently applied, but if there is no such field available this need not prevent the taking of samples, for the purpose of the investigation is to study the conditions under which the plants are growing in the field under ordinary operations of the farm.

Having selected the spot in conformity with the above instructions, there are two reliable methods for collecting the samples—with a spade and with an auger. To collect the samples with a spade, remove all grass, leaves, or litter from the surface and dig a hole like a post hole 24 inches deep. Scrape the sides clean and notice the depth at which the change of color occurs between the soil and the subsoil. Take a sample of the soil above this by cutting off a slice of soil 3 or 4 inches thick, down to the change of color, and mixing this thoroughly together. Fill a cloth sack with this well-mixed soil, tie it securely, and label it with such information as will serve to identify it when it is received in the laboratory. Then clean out the hole again and scrape the sides so as to get rid of every particle of the top soil, and take a sample of the subsoil in like manner by cutting down a slice of the subsoil and thoroughly mixing it together so that the sample shall contain particles of the subsoil from immediately below the top soil to a depth of at least 24 inches. Put this sample of the subsoil into a separate sack, tie it securely, and label it. If there is no apparent difference between the soil and the subsoil, take a sample of the soil nevertheless to a depth of 6 inches from the surface, and a sample of the subsoil from below this to a depth of 24 inches, and put them into separate sacks as above. If the character of the subsoil materially changes before the depth of 24 inches is reached, a separate sample of this changed material should be taken and the depth noted at which the change occurs.

To collect samples with an auger, take a common wood auger from $1\frac{1}{2}$ inches to 3 inches in diameter and have the handle lengthened to 24 or 30 inches. Remove the litter and grass as before from the surface of the field and bore into the soil, pulling up the auger and emptying the sample into a sack for every 3 or 4 inches in depth. The depth of the top soil should be determined by a preliminary boring. Care must be taken to separate the top soil from the subsoil and to keep them in separate sacks. If there is a marked difference in the character of the subsoil within 18 or 20 inches of the surface, a separate sample should be taken of the second subsoil, the depth of each being carefully noted.

It is very important that the samples be taken, as far as practicable, to a uniform depth, to secure the greatest comparative value in the work. The plan adopted by this Division is to take the sample of top soil to a depth of at least 4 or 6 inches, or

to the change of color where this is apparent within 9 or 12 inches of the surface. The subsoil is then sampled to a depth of at least 24 inches in the case of very stiff clays, and to a depth of 24 or 30 inches in the lighter soils. It occasionally happens from the nature of the subsoil that the samples can not be taken to a depth of 24 or 30 inches. In any case the actual depth represented by each sample should be stated—such as: "0 to 6 inches;" "6 to 24 inches,"—and a note made of the character of the sample.

Three sizes of sacks are used by this Division for the collection of soil samples. When the samples are taken with a spade, 8 to 10 pounds of material should be collected and put into a cloth sack, 14 by 8½ inches, of heavy, unbleached muslin. For samples taken with the auger, a smaller sack can be used, as the sampling is usually more accurately done. Sacks 6 by 8½ inches are very convenient for this purpose. As the sample of the top soil is usually smaller than that of the subsoil, and as it is usually of relatively less importance, smaller sacks, 4 by 6 inches, may be conveniently used for the sample of top (surface) soil. This is likewise a very convenient size to take on an expedition when a large number of samples are to be taken and when the weight of material is an important consideration. These sacks have short pieces of string or tape sewed to them for convenience in tying, and they should each be numbered with a stencil for convenience in referring to them in the field notes.

AGENCIES THROUGH WHICH THE PRESENT COLLECTION HAS BEEN OBTAINED.

By far the largest part of the soil collection has been obtained by agents of the Department of Agriculture who have personally visited the areas and taken representative samples. As already stated, a number of samples were obtained at the same time and from the same sources as the soil collection exhibited at Chicago.

A number of soils from Alabama and California, collected for the Tenth Census, were obtained for the collection through Dr. E. A. Smith and Prof. E. W. Hilgard. A few samples have been obtained from State geological surveys, and, lastly, a very few samples have been obtained from private individuals.

It has been the invariable rule not to add samples to the collection unless the exact origin of the samples is known and some important reason is assigned which would make the samples of possible value in the future investigations of the Division.

The agencies through which the various samples have been collected are plainly stated in all cases in this catalogue.

HOW THE SAMPLES ARE STORED.

The samples in the collection are stored in air-tight glass jars and put on shelves easily accessible in the basement of the building occupied by the Division of Soils. The first 2,000 samples are in half-gallon glass preserve jars. In many cases these are quite full, in other cases they contain only very small samples. With the introduction of the auger as a method of collecting soil samples, it was deemed unnecessary to take so large a sample to represent the area; furthermore, with the widely extended work of the Division, the collection became very bulky, and it was found troublesome to handle such large samples, so

that the second 2,000 samples were stored in pint preserve jars. This gives an adequate sample for most purposes and makes it possible even to exchange small samples with other institutions. In many cases these pint jars are quite full, but in most cases the sample about half fills the jar. Of course most of the soil formations are represented by a number of samples, and in most cases a composite sample could be made up which would represent the soil area even better, perhaps, than an individual sample would do.

In addition to this collection in jars there is also a collection of larger samples of from 200 to 400 pounds each of some of the most important and most interesting soil formations, which are used for the study of their particular properties and to illustrate certain principles which it is desired to bring out. These large samples are contained in bins. Furthermore, the extensive correspondence of the Department and the connections which have been established with individuals and with local institutions in the course of the soil investigations, and the trips that have been made by members of the Division, make it possible to collect larger representative samples from almost any area which it is desired to study.

The soils when received at the laboratory are immediately air dried and are stored in the jars in this condition without grinding or pulverizing the lumps, except when it may be necessary to break the larger lumps in order to get the material into the jars.

CARD CATALOGUE.

The samples when received are immediately given a serial number in the catalogue. A system of cataloguing is used which makes it possible to find a sample very quickly if the number, locality, or any important part of the description of the sample is known. This is done through a series of cross references. There is a catalogue of small cards, in which the numbers are arranged serially in groups by hundreds. These cards contain merely the locality from which the sample is derived, the geological formation where this is known, the crop or other distinguishing agricultural feature, and the depth of the sample. The complete information in regard to the sample is then put upon a larger card, 4 by 6 inches, containing everything relating to the sample; including the locality from which it comes, the collector, the geological formation, the crops, and such other information as may be available. These cards are arranged first according to States, and under each State according to some characteristic feature, usually the geological formation or the type of crop. This makes it easy to find the samples from any particular State and any particular sample in the State, if the geological formation or the crop is known, as these are put at the top or at the side of the card in such a way as to quickly call attention to the character of the sample in turning over the cards.

Samples of the top soil and of the subsoil are catalogued separately, are given separate numbers, and are treated in every way as separate

samples. This was found necessary at a very early time in the soil investigations.

Approximately one-half of the samples represent top soils and the remaining half subsoils. The average depth of the soils is about 6 inches, and the subsoils usually extend from this depth to a depth of 24 or 30 inches. If there is any marked difference in the subsoil two or more samples are taken. This is determined solely by an examination in the field.

It is usually considered that the subsoil gives the principal character to the physical properties of the land, and more of the subsoil samples have been examined than of the top-soil samples. A complete mechanical analysis has been made of nearly half the samples in the soil collection (1,756), and 700 of these have been published in various publications. These facts are shown in the accompanying catalogue, and reference is made to the reports or papers where the analyses are published. They are scattered through about twenty-seven different publications.

CLASSIFICATION OF THE SOILS.

It is impossible to work out with the dried specimens of a collection a system of classification which can be used in detailed field investigations in connection with the mapping of soil areas. In arranging the samples the object has been to correlate them as far as possible with the geological formations, the physiographic regions, or the agricultural districts in order that they can be identified in subsequent investigations. There are two comparatively well-defined and seemingly distinct lines in soil investigations. One has to do with the investigations of soils in the abstract in the laboratory and with laboratory methods. This includes the investigation of their petrographical origin and condition, their chemical composition, and certain physical properties. For such investigations these dried samples from a soil collection may answer very well, at least for the general and preliminary stages of the work, but where the more important work begins, of mapping the soils in the field, these dried samples are of little value, except in establishing the types. The mapping of soils in the field with their local peculiarities and departures from the normal type and the different grades and subtypes, to bring out their comparative agricultural value, opens up an entirely new field of work and requires a distinct system of classification and of nomenclature. The system of classification, therefore, adapted to laboratory investigations and the arrangement of a soil collection can never be used without material modification for the advanced field investigations in the mapping of soils. It must be understood, therefore, that the terms used in the classification of the soils in the collection are not necessarily adapted to the classification of the soils in the field and to the areal mapping of the formations.

An endeavor has been made to correlate the samples with the geological formation from which the soil was derived. This has been

done in most cases, but it has not been possible in all. Furthermore, the physiographic peculiarities of a region, or the agricultural crops in some cases, are such important factors that, for the purpose of identifying the sample, these have been used rather than the geological formation. In some cases the geological formation might have been given also, but being relatively unimportant it has not been considered necessary to carry out the system of classification through all the ramifications and cross references which this would have involved. The system of classification may appear at first sight, therefore, to be rather illogical, but a more careful consideration will make it appear evident that, for the purpose in view, the arrangement is probably the best that could be devised.

It will be seen, on a careful consideration of the subject, that there are many principles to be observed in the arrangement and classification of the samples in a soil collection. The first of these in order of importance is undoubtedly the geological formation. In many cases this places the sample geographically with much precision, and at the same time it may describe also the general character of the soil. A sample from the Cambrian shales of Maryland must come from one of two or three narrow belts crossing the western part of the State, and, to one who is familiar with the character of the rock of this locality and the way it disintegrates, it is at once apparent that the typical sample will contain a large amount of stone, forming what is known agriculturally as a stony soil. A sample of the Trenton limestone from Maryland can come only from the Frederick or Hagerstown valleys, and a typical sample will contain a high per cent of clay, and represent a very fertile area. A sample of the same formation from Alabama, however, will be a very different soil, containing a large proportion of chert, and will represent a very infertile area. This is due to the difference in the character of the limestone rocks in these widely separated areas. A sample of the Columbia formation in Maryland will come from the coastal plains. It is of unconsolidated material, and it may be either a coarse, sandy soil from the truck lands along the bay and ocean or a heavier clay soil adapted to wheat and corn, according to the relative elevation in the formation from which it was derived. Within this coastal region, however, there are similar light sandy soils adapted to truck, which are derived from the Cretaceous, Eocene, Chesapeake, and Lafayette, and these differ in no essential characteristic, so far as can be determined, from the truck soils of the Columbia. As the areas of these geological formations are not at present very well defined and are imperfectly understood, and as the truck area is confined entirely to this class of soils, and forms an important and distinct agricultural district, these soils along the whole Atlantic coast line have been classed as "truck lands, mainly Columbia," with the other formations given in connection with the individual samples wherever it is known.

The classification of the soils in Kansas will, perhaps, bring out more clearly than can be shown in any other way the objects which have

been attained in the system of classification adopted for the collection. Most of the samples from Kansas are classed under the principal head of prairie. This brings out both a physiographic and an agricultural relation which it is important to recognize. Many theories have been advanced as to the origin of the prairie, to explain why trees are not found over such vast areas in our Southern and Western States. It has been held by many that it is on account of the physical peculiarities of the soil. It will be seen, however, that the soil collection contains a great variety of soil formations classed under the head of prairie. There are the Benton limestone, the Dakota sandstone, Columbia, loess, and plains marl—all forming strong agricultural soils of very different texture.

In Illinois we have samples of the loess from wooded areas, and samples of the same formation, having apparently the same texture and physical properties and the same chemical composition, from prairie. These are important matters to consider in considering the origin and cause of the prairie soils.

Under the head of "Prairie" in Kansas, the Benton limestone refers to a geological formation. The loess and plains marl represent soils of peculiar and marked physical texture. The alkali soils represent areas where the local accumulation of soluble salts is so great as to become a factor in crop production. The salt-grass lands and the blue-stem soil represent areas where a persistent type of peculiar vegetation indicates either chemical or physical characteristics which are unsuited for most of our agricultural crops. The gumbo soil represents a condition rather than a kind of soil. For the purposes for which a soil collection is used, the term gumbo is really all that is required in the classification, except for a special study of the origin and cause of such conditions, and it is relatively unimportant whether the gumbo occurs in the Dakota sandstone or in any of the other formations. The term gumbo sets it forth with certain well-marked properties which are recognized, locally at any rate, as an important agricultural type of land. All of these types of soil are found in the prairie region of Kansas, and in the classification we have used the origin, chemical composition, texture, vegetation, or condition of the soil as distinctive terms to base the classification upon.

The terms used in this collection are believed to very fully identify the samples, and where this can be done with a term which is not too local, it is not considered necessary to follow out all the relations and give the great number of cross references which would be required if all the systems which are used in part should be carried out and logically connected. It may easily happen, therefore, that anyone familiar with local formations may see relationships which are very apparent to him, but which are not considered necessary in this place, and which are, therefore, not included. This is brought out clearly in the alphabetical list of soil formations represented in the collection.

Many cross references have, however, been used, and in the alphabetical list of formations the same sample may be classed under several

heads. This has been carried as far as is believed wise with the material at hand.

The idea of special collections has been kept very clearly in mind from the first, as giving promise of great value in using the collection. For this purpose the alphabetical arrangement of the formations will be found extremely valuable in showing localities from which samples of a particular type have been collected. The various limestone soils have all been brought into one group, with the States from which each of the various kinds of limestone soil has been obtained. All the localities from which the loess has been obtained are given. Special collections have been made of soil from the truck areas and from the important tobacco districts, and these are grouped according to the type of tobacco produced, the geological formations from which the soils have been derived, and the States from which samples have been obtained. So far as possible, the corn, wheat, cotton, rice, and sugar-cane lands have also been brought into groups, and it is believed that such grouping will give an added value to the collection, especially when the material has all been examined.

It must not be understood that all of the samples designated as corn land or as wheat land are equally adapted to the production of these crops. They all come from areas in which these form important crops, but the samples in the group may represent all grades of soil within that district from the most productive to the least productive in order to give material for a comparative study of the influence of soils upon the crop. It must not be understood that only on those formations to which wheat and corn are accredited can these crops be successfully grown. These crops have only been given in connection with areas upon which they are considered important and characteristic; the same crops are grown on many and probably on most of the other formations but to a relatively unimportant extent.

The grass lands include only those in the Eastern States which are well adapted to hay grass. It has been thought impracticable to include the pasture lands in the collection.

While the main features of the collection are brought out in the large groups of samples, designated by their geological origin and their agricultural crop value, still many of the unclassified samples are of great economic or scientific value. They nearly all have some marked peculiarity which gives them a place in such a collection of soils. Where possible these peculiarities have been indicated by a word directly following the serial number of the sample.

ARRANGEMENT OF THE CATALOGUE.

The arrangement of the catalogue can be easily understood from the method of classification which has just been described. In the first part of the catalogue the samples are arranged according to States and according to geological formations, physiographic features, or crop

areas. Under each of these groups is given the serial numbers of the samples, arranged by soils and subsoils, and the counties or townships from which they have been derived. An asterisk (*) following a number indicates that a mechanical analysis has been made of the sample, and a degree mark (°) indicates that a chemical analysis has been made. Where either of these has been published a reference is made to the bulletin or paper in which the results appear. Where such reference is not made the results are among the unpublished records of the Division of Soils. The agency through which the samples were obtained is given in all cases, as this is important in judging of the representative value of the sample.

The second part of the catalogue gives the samples arranged serially with a brief description, which will serve to identify the sample, and with a reference to the page upon which it is fully described in the State classification.

The third portion of the catalogue gives an alphabetical list of the formations represented, with the States or foreign countries from which the samples have been obtained. The number of samples from each State is given as an indication of the magnitude of the collection from any particular locality. This gives a valuable idea of the relative distribution of the collection according to the formations and States represented.

The catalogue as thus arranged renders it easy to refer to any sample in the collection if the State, geological formation, or serial number is known.

CLASSIFICATION OF SAMPLES UNDER STATES AND COUNTRIES FROM WHICH THEY HAVE BEEN OBTAINED.

ALABAMA.

(157 samples.)

The samples from Alabama are mainly from two sources. Part of them were presented by Dr. E. A. Smith, director of the geological survey of Alabama, from the collection made for the report on cotton production in Alabama for the Tenth Census. A description of these samples is given in Vol. VI of the Tenth Census and in the agricultural volume of the report of the geological survey of Alabama, 1881–82. The original numbers by which the samples are designated and under which they are described are given in parenthesis and immediately following the serial numbers of the Division of Soils. The geological correlation, published in the Tenth Census, has been somewhat modified as the result of subsequent work of the State geological survey. These modifications have been adopted so far as it is possible to do so. In addition to the references above cited, see also the bulletins and various papers in the annual reports of the United States Geological Survey on the Cretaceous, Eocene, Lafayette, and Columbia formations. Numbers followed by the sign (°) have had a chemical analysis,

and in all cases these chemical analyses have been published in Vol. VI of the Tenth Census and in the agricultural volume of the State geological survey.

During the season of 1891 the Alabama Experiment Station conducted an interesting series of fertilizer experiments with cotton in different parts of the State and on a great many different types of soil. The results were published in Bulletin No. 34 of the station. The results obtained were so very interesting and the differences recorded by the various farmers were so widely different that samples of the soils and subsoils were obtained through correspondence with each of the farmers who had cooperated in the work. The list of localities, together with the description of the samples submitted by the farmers and such other data as were brought together, was sent to Dr. E. A. Smith, and the samples were correlated as accurately as possible with the geological formations of the State. From the very full description of the localities and the character of the soil it is believed that this correlation is reasonably accurate. The markedly different yields of these soils with different fertilizers and fertilizer ingredients, reported in Bulletin 34 of the Alabama Experiment Station, indicate a very interesting problem to study, but the time and opportunity for this have never been presented, so that the samples have not yet been analyzed.

[Mechanical analyses have been made of samples marked (*) and chemical analyses have been made of samples marked (°).]

Alluvial (1 soil).

Soil 824 (1), (black swamp muck), Autauga County. Dr. E. A. Smith, collector.

Barrens—cotton, corn (3 soils, 2 subsoils).

Soils 852° (40), 853 (42) (swamp barrens), 860° (48), subsoils 854* (41), 859* (47), (hardpan), Madison County. Dr. E. A. Smith, collector.

Cambrian shales (2 soils, 2 subsoils).

Soil 662, subsoil 663, Shelby County. Dr. E. A. Smith, collector.

Soil 510, subsoil 511, Cherokee County. Collected by farmers cooperating with the Alabama Experiment Station.

Coal measures (1 soil, 1 subsoil).

Soil 552, subsoil 553, Cullman County. Collected by farmers cooperating with the Alabama Experiment Station.

Corn lands (73 soils, 67 subsoils).

See Barrens, cretaceous, drift, gneiss, gunpowder-lime land, hammock, Lafayette, limestone, post-oak flatwoods, prairie, unclassified.

Cotton lands (73 soils, 67 subsoils).

See Barrens, cretaceous, drift, gneiss, hammock, Lafayette, limestone, post-oak flatwoods, prairie, unclassified.

Cretaceous—cotton, corn, wheat (5 soils, 2 subsoils).

Soil 672* (green sand), Perry County. Dr. E. A. Smith, collector.

Soil 520, subsoil 521, Lowndes County. Collected by farmers cooperating with the Alabama Experiment Station.

Soil 1926, Lee County; soils 1923, 1925, subsoil 1924*, Perry County. Collected by agents, United States Department of Agriculture.

Drift—cotton, corn (1 soil, 1 subsoil).

Soil 1921, subsoil 1922, Lee County. Collected by soil observers, Division of Soils.

Gneiss—cotton, corn, wheat (9 soils, 4 subsoils).

Soil 675* (hornblendic), Chambers County; subsoil 678, Clay County; soil 679, Coosa County; soil 680 (hornblendic), Lee County; soils 673*, 674* (hornblendic), Randolph County; soils 676, 677 (mica-schist), Tallapoosa County. Dr. E. A. Smith, collector.

Subsoil 529 (hornblendic), Clay County; soil 548, subsoil 549, Randolph County; soil 540, subsoil 541, Tallapoosa County. Collected by farmers cooperating with the Alabama Experiment Station.

Hammock land—cotton, corn (4 soils, 2 subsoils).

Soil 830*° (9), Montgomery County; soils 833° (20), 834° (21), subsoil 835° (22), Tuscaloosa County; soil 855 (43), subsoil 856 (44), Cahaba River. Dr. E. A. Smith, collector.

Lafayette (orange sands)—cotton, corn (22 soils, 32 subsoils).

Soils 825° (3), 827*° (6), 869 (59), subsoils 826*° (4), 828* (7), 829 (8), 868* (58), 870*° (60), 871 (62), Autauga County; soil 885° (96), subsoils 883° (94), 884 (95), 886 (97) Barbour County; subsoil 882° (91), Clarke County; subsoil 880* (85), Henry County; soil 887 (124), Pickens County; soil 836 (23), subsoils 837 (24), 841* (28), Sumter County; subsoil 832° (19), Pike County. Dr. E. A. Smith, collector.

Soil 506, subsoil 507, Autauga County; soil 518, subsoil 519, Barbour County; soil 494, subsoil 495, Bibb County; soil 550, subsoil 551, Bullock County; soil 544, subsoil 545, Butler County; soil 498, subsoil 499, Clarke County; soil 530, subsoil 531, Chilton County; soil 492, subsoil 493, Covington County; soil 526, subsoil 527, Dale County; soil 536, subsoil 537, Fayette County; soil 554, subsoil 555, Geneva County; subsoil 533, Greene County; subsoil 557, Henry County; soil 504, subsoil 505, Lowndes County; soil 512, subsoil 513, Macon County; soil 502, subsoil 503, Marengo County; soil 546, subsoil 547, Pike County; soil 514, subsoil 515, Washington County. Collected by farmers cooperating with the Alabama Experiment Station.

Limestone (20 soils, 18 subsoils).

Gunpowder-lime land—cotton, corn (1 soil, 1 subsoil).

Soil 291, subsoil 292, Montgomery County. George F. Atkinson, collector. (Soil on which cotton rusts more or less every year).

Knox dolomite—cotton, corn (6 soils, 7 subsoils).

Soils 876 (72), 877 (73), subsoil 878 (74), Calhoun County; subsoil 862* (50), Madison County; soils 664, 666, subsoils 665, 667, Shelby County. Dr. E. A. Smith, collector.

Soil 534, subsoil 535, Blount County; subsoil 509, Etowah County; soil 542, subsoil 543, Shelby County. Collected by farmers cooperating with the Alabama Experiment Station.

Quebec dolomite—cotton, corn (2 soils, 2 subsoils).

Soil 857 (45), subsoil 858 (46), Bibb County; soil 879° (76), subsoil 872 (63), Talladega County. Dr. E. A. Smith, collector.

St. Louis limestone ("red lands")—cotton, corn, wheat (10 soils, 7 subsoils).

Soils 846*° (34), 866° (56), subsoil 847* (35), Colbert County; soils 850*° (38), 861 (49), subsoil 851* (39), Madison County; soils 864 (54), 873° (64), subsoil 865* (55), Franklin County. Dr. E. A. Smith, collector.

Soil 490, subsoil 491, Franklin County; soil 496, subsoil 497, Madison County; soil 524, subsoil 525, Morgan County. Collected by farmers cooperating with the Alabama Experiment Station.

Soil 3608*, subsoil 3609*, Jackson County. J. H. Leslie, collector.

Trenton limestone—cotton, corn (1 soil, 1 subsoil).

Soil 668, subsoil 669*, Shelby County. Collected by farmers cooperating with the Alabama Experiment Station.

Post-oak flatwoods—cotton, corn (3 subsoils).

Subsoils 838*° (25), 839° (26), 840 (27), Sumter County. Dr. E. A. Smith, collector.

Prairie—cotton, corn (5 soils).

Soil 670*, Wilcox County; soil 671*, Choctaw County; soil 843° (30), Jones Bluff; soil 844 (31), 845*° (32), Sumter County. Dr. E. A. Smith, collector.

Truck land (5 soils, 5 subsoils).

Soils 3598*, 3600*, 3602*, 3604*, 3606*, subsoils 3599*, 3601*, 3603*, 3605*, 3607*, Baldwin County. Collected by private individuals.

Unclassified—cotton, corn (4 soils, 3 subsoils).

Soil 443 (61), Autauga County; soils 848° (36), 849* (37) (pipe clay), Colbert County; subsoil 874 (65), Franklin County; subsoil 863 (51), Madison County. Dr. E. A. Smith, collector.

Soil 293, subsoil 294, Montgomery County. George F. Atkinson, collector.

Wheat land (24 soils, 13 subsoils).

See Cretaceous, gneiss, St. Louis limestone.

ALASKA.

(44 samples).

The samples from Alaska were collected by Dr. Sheldon Jackson in 1899 in his trips of reconnoissance and by Dr. Walter Evans of the Office of Experiment Stations of this Department, under authority of the Act of Congress authorizing the Secretary of Agriculture to examine and report upon the feasibility of establishing an experiment station in Alaska.

It has been impossible from the data available to correlate these samples in accordance with the geological formations, as so little is known about the geology of Alaska. Furthermore, as the samples were taken in many cases in wild uncultivated regions, it has not been possible to classify the soils satisfactorily into groups of any kind. They are mainly peat soils, very rich in organic matter.

[Mechanical analyses have been made of samples marked (*).]

Unclassified (24 soils, 20 subsoils).

Soil 3643*, subsoil 3644*, Anvik; soil 3645*, 3647*, subsoils 3646*, 3648*, Circle City; soil 3455*, Etholine Island; soils 3649*, 3650*, Fort Adams; soil 3654*, Fort Andreafski; soil 3651*, Fort Cudahy; soils 3438*, 3439*, 3444*, subsoils 3440*, 3441*, 3442*, 3443*, Fort Wrangell; soils 3456*, 3458*, 3460*, subsoils 3457*, 3459*, 3561*, Juneau; soils 3462*, 3463*, 3465*, subsoils 3464*, 3466*, 3696, Kadiak; soils 3445*, 3446*, 3447*, 3448*, subsoils 3449*, 3450*, Sitka; soil 3453*, subsoils 3451*, 3452*, 3454*, Stikine River; soil 3652, subsoil 3653, Unalaklik; soil 3655*, subsoil 3656*, Koserefski.

Mechanical analyses, 3438, 3439, 3440, 3441, 3442, 3443, 3444, Fort Wrangell; 3445, 3446, 3447, 3448, 3449, 3450, Sitka; 3456, 3457, 3458, 3459, 3460, 3461, Juneau; 3462, 3463, 3461, 3465, 3466, Kadiak; published in Bulletin No. 48, Office of Experiment Stations, page 11.

ARGENTINA.

(25 samples.)

The samples from Argentina were collected under the direction of Prof. W. G. Davis, Director de la Oficina Meteorológica, Argentina, at Cordova. The collection was to represent the important wheat lands

of Argentina. Only a portion of the collection has been received as yet. These samples were collected at the request of the Division of Vegetable Physiology and Pathology in connection with some investigations on wheat rust, and form a part of a series of samples representing the soils of the important wheat districts of the world.

[Mechanical analyses have been made of samples marked (*).]

Wheat lands (25 samples).

3657*, Rosario; 3658*, Perez; 3659*, Zavalla; 3660*, Villa Casilda; 3661*, Arequito; 3662*, Juarez Celman; 3663*, Villada; 3664*, Melincue; 3665*, 3666*, 3667*, 3668*, 3669*, 3670*, 3671*, 3672*, 3673*, 3674*, 3675*, 3676*, 3677*, 3678*, 3679*, 3680*, 3681*, Chubut.

ARIZONA.

(1 sample.)

Only a single sample of soil has been collected from Arizona, a sample of silt from the Gila River, collected by one of the members of the United States Geological Survey. It is stated that when this silt is deposited on the banks of canals, it seems to have the property of diminishing the resistance to the flow of water and of accelerating the movement of water in the canals. It is furthermore very resistant to the eroding action of water in the time of a flood, and a slight amount of this substance will protect a ditch from the action of a large volume of water.

Silt (1 sample).

3240, from the Gila River.

ARKANSAS.

No samples have been collected from this State.

BERMUDA.

(12 samples.)

The samples from Bermuda were collected with reference to an investigation being carried on by the Division of Vegetable Physiology and Pathology on a disease of the Bermuda lily. The collection includes samples of new soils suitable for growing the lilies and of old soils upon which the lilies are said to become very much diseased. These samples were all collected and sent at the request of the Department by growers in Bermuda or by agents of the Department.

[Mechanical analyses have been made of samples marked (*).]

Unclassified (12 soils):

Soils, 3064, 3065, 3477,* 3478,* 3479*, 3976 (coral sand), 3977, 3995, 3996, 3997, 3998, 3999.

CALIFORNIA.

(90 samples.)

The origin of the samples from California is threefold. Part of them are from the collection made under the direction of Dr. E. W. Hilgard, of the University of California, for the report on cotton production in

California for the Tenth Census. These samples are described in Vol. VI of the Tenth Census, including the chemical analyses of most of them. The numbers given in parentheses, following the serial numbers of this Division, are the original numbers under which the samples are described in the Tenth Census. The classification of this part of the collection is the same as that adopted by Professor Hilgard in the census work.

A few additional samples were furnished by Professor Hilgard when material was being collected for the soil exhibit at the Columbian Exposition. The remaining samples from California were collected by agents of this Department.

A very full description of the formations can be found in Vol. VI of the Tenth Census and in the numerous reports and bulletins issued by the California Experiment Station. The collection contains many samples of great interest on account of the peculiar properties exhibited in their relation to water and to plant growth. Many of these interesting properties have been referred to repeatedly by Dr. Hilgard, and some of the most striking properties have been described by the writer in a short article in the Yearbook of the Department of Agriculture for 1897, entitled "Some interesting soil problems."

Some of the soils from the Fresno plains possess the peculiar property of subirrigation on a very extensive scale. After irrigation has been practiced for some years the subsoil becomes filled with water, the wells from being 80 to 100 feet deep are only 2 to 6 feet deep to water, and the fields support vegetation without irrigation if only the water is allowed to run in the main canals, which may be as much as a mile apart. Part of the samples from the Tulare plains show even more marked peculiarities than this, supporting large fruit crops without irrigation and with but 9 or 10 inches of rain falling during the winter months. Other samples from the same locality have no such remarkable power and require frequent irrigation.

The soils classed as fruit lands of southern California also have this power to a more or less marked degree of supporting vegetation with little or no irrigation and, although there is no rain during the season of actual growth, the soil becomes moist with the winter rains of 18 or 20 inches, and the crops are matured with no further rain during the growing season and with no necessity for irrigation. Other soils in this same locality, having apparently the same texture and composition, require irrigation to mature a crop. Particular interest centers in sample No. 3432, from a sandy field near Pomona where a second crop of tobacco was being harvested from the suckers which had been allowed to grow from the main crop, although there had been no rain and no irrigation during the entire season of growth. The water in the wells was about 30 feet from the surface. The soil was still moist within 2 or 3 inches of the surface.

The soils of the Mojave Desert are interesting from the apparent

sterility of the land in its native condition, and yet there is no apparent cause for this in the physical texture or the chemical composition of the soils, as compared with like properties of soils from other localities in adjoining counties. With only 5 inches of annual rainfall and located 15 or 20 miles from the mountains, it is possible in many places in the Mojave Desert to find standing water within 5 or 6 feet of the surface. This is usually quite alkaline, but the soils do not appear to be sufficiently alkaline, except as a result of injudicious irrigation, to account for the sterility in their natural condition.

The collection of alkali soils has been made for a special study in connection with other alkali soils of the United States.

The foothill soils have the property of supporting vegetation through long periods of dry weather and they form some of the most valuable wheat lands.

The adobe soils have the general properties of a compact clay, exceedingly difficult to till and yet very productive when properly treated. While possessing the properties of clay, they are composed mainly of silt and are extremely interesting in showing these physical properties with the great difference existing between them and the true clay soils.

[Mechanical analyses have been made of samples marked (*). Chemical analyses have been made of samples marked (°).]

Adobe—wheat (6 soils).

Soils 341*° (1), 342*° (4), Alameda County; soil 327*° (570), Fresno County; soil 343*° (6), San Joaquin County; soil 336*° (68), Tuolumne County. Collected by Dr. E. W. Hilgard for the Tenth Census.

Soil 3404*, Orange County. Collected by agents of the United States Department of Agriculture.

Mechanical analyses of samples 336, 341, 342, 343 (by Professor Hilgard's method of elutriation) are published in Vol. VI, Tenth Census, Cotton Production of California, page 83. Chemical analyses of samples 327, 336, 341, 342, 343, are published in the same volume, pages 79–81.

Alkali land (11 soils, 13 subsoils).

Soil 345*° (9), San Joaquin County. Collected by Prof. E. W. Hilgard for Tenth Census.

Soils 3406, 3407, Orange County. Collected by agents of the United States Department of Agriculture.

For additional samples, *see* Fresno Plains, Mojave Desert, Tulare Plains, unclassified.

Mechanical analysis 345 (by Professor Hilgard's method of elutriation) is published in Vol. VI, Tenth Census, Cotton Production of California, page 83.

Alluvial soils (5 soils, 1 subsoil).

Soil 1021, Los Angeles County; soil 1115 (prairie), Solano County; soils 967, 968, Tulare County. Collected by Prof. E. W. Hilgard for Columbian Exposition.

Soil 3408 (celery), subsoil 3409* (celery), Orange County. Collected by agents of the United States Department of Agriculture.

Fresno Plains (7 soils, 5 subsoils).

Soil 328*° (704), Fresno County. Collected by Prof. E. W. Hilgard for Tenth Census.

Soil 798, Fresno County. Collected by Prof. E. W. Hilgard for the Columbian Exposition.

Fresno Plains (7 soils, 5 subsoils)—Continued.

Soils 3393, 3394*, 3396*, 3397 (alkali), 3400*—subsoils 3391, 3392 (hogwallow), 3395, 3398 (alkali), 3399* (alkali), Fresno County. Collected by agents of the United States Department of Agriculture.

Mechanical analysis 3394 is published in Yearbook, Department of Agriculture, 1897, page 440.

Chemical analysis 328 published in Vol. VI, Tenth Census, Cotton Production of California, page 79.

Greenhouse soil—roses, carnations (2 samples).

Soil 2250*, Alhambra; soil 2261, San Francisco.

Limestone soil (1 soil).

Soil 966, Santa Clara County. Collected by Prof. E. W. Hilgard for the Columbian Exposition.

Mojave Desert soil (3 soils, 6 subsoils).

Soil 337*° (332), Kern County. Collected by Prof. E. W. Hilgard for the Tenth Census.

Soils 3387*, 3389*, subsoils 3383 (alkali hardpan), 3384 (alkali hardpan), 3385 (alkali), 3386 (alkali), 3388*, 3390 (alkali), Los Angeles County. Collected by agents of the United States Department of Agriculture.

Mechanical analysis 3388, published in Yearbook, Department of Agriculture, 1897, page 440.

Chemical analysis 337 published in Vol. VI, Tenth Census, Cotton Production of California, page 80.

Tobacco land, cigar type (1 soil, 1 subsoil).

Soil 2262 subsoil, 2263*, Marin County. Collected by private individuals.

Mechanical analysis 2263 published in Bulletin No. 11, Division of Soils, page 42.

Tulare Plains (10 soils, 7 subsoils).

Soils 329*° (586), 330° (573), 346*° (585) (wire-grass soil), Tulare County. Collected by Prof. E. W. Hilgard for Tenth Census.

Soils 3377 (alkali), 3378* (alkali), 3381* (alkali), 3410*, 3412 (alkali), 3414 (alkali), 3416*, subsoils, 3379 (alkali hardpan), 3380 (alkali), 3382 (alkali), 3411*, 3413 (alkali), 3415* (alkali), 3417*, Tulare County. Collected by agents of the United States Department of Agriculture.

Mechanical analyses 3378, 3416, published in Yearbook, Department of Agriculture, 1897, page 440. Mechanical analysis 329 (by Professor Hilgard's method of elutriation) published in Vol. VI, Tenth Census, Cotton Production of California, page 83.

Chemical analyses 329, 330, 346, published in Vol. VI, Tenth Census, Cotton Production of California, pages 79–81.

Unclassified (23 soils, 6 subsoils).

Fruit land of southern California (14 soils, 3 subsoils)

Soils 3430*, 3432*, subsoil 3431*, Los Angeles County; soil 3405, Orange County; soils 3401*, 3402* (mesa), Riverside County; soils 3403*, 3433 (alkali), 3435, 3437* (alkali), subsoils 3434 (alkali), 3436, San Bernardino County. Collected by agents of the United States Department of Agriculture.

Soil 1020, San Bernardino County; soil 969, San Luis Obispo County; soil 1019, Ventura County. Collected by Prof. E. W. Hilgard for the Columbian Exposition.

Soil 338*° (382) (mesa), Los Angeles County; soil 339*° (168), Ventura County. Collected by Prof. E. W. Hilgard for Tenth Census.

Mechanical analysis 339 (by Professor Hilgard's method of elutriation), published in Vol. VI, Tenth Census, Cotton Production of California, page 83.

Chemical analyses 338, 339, published in Vol. VI, Tenth Census, Cotton Production of California, page 80.

Unclassified (23 soils, 6 subsoils)—Continued.

Miscellaneous (9 soils, 3 subsoils).

Soil 699, subsoil 700, Alameda County; soil 1116, Shasta County. Collected by Prof. E. W. Hilgard for the Columbian Exposition.

Soil 331*° (700) (salt grass soil), Kern County; soil 344*° (8), San Joaquin County; soils 332*° (705) (red chaparral), 340*° (702) (red chaparral), subsoil 333*° (706) (red chaparral), Shasta County; soil 1058, Sonoma County. Collected by Prof. E. W. Hilgard for Tenth Census.

Subsoil 3975 (irrigation hardpan), Los Angeles County. F. L. Palmer, collector.

Soils 3980, 3981, Los Angeles County. J. Sterling Morton, collector.

Mechanical analysis 344 (by Professor Hilgard's method of elutriation), published in Vol. VI, Tenth Census, Cotton Production of California, page 83.

Mechanical analysis 3432, published in Yearbook, Department of Agriculture, 1897, page 440.

Chemical analyses 331, 332, 333, 340, published in Vol. VI, Tenth Census, Cotton Production of California, pages 79–81.

Wheat land (8 soils).

Soil 335*° (51) (red foothill soil), Placer County; soil 334*° (499), Yuba County. Collected by Prof. E. W. Hilgard for Tenth Census.

For additional samples of wheat land, *see* adobe.

Mechanical analysis 335 (by Professor Hilgard's method of elutriation), published in Vol. VI, Tenth Census, Cotton Production of California, page 83.

Chemical analyses 334, 335, published in Vol. VI, Tenth Census, Cotton Production of California, page 80.

CHINA.

(1 sample.)

A single sample from China is contained in the collection. This is of interest as it represents the loess formation, the origin of which has been so much discussed in geological literature. This sample is from a larger one in the United States National Museum. It is interesting to note that it has the same texture as the loess formation in our Western States, shown particularly in the samples from Nebraska and Illinois which have been examined.

[Mechanical analysis has been made of sample marked (*).]

Loess (1 sample).

2726*, Chinkiang.

COLORADO.

(17 samples.)

[Mechanical analyses have been made of samples marked (*). Chemical analysis has been made of sample marked (°).]

Alkali land (1 soil).

Soil 793. Walter J. Quick, collector.

Kaolinite (1 soil).

Soil 3241°, San Juan County. Whitman Cross, collector.

Prairie (10 soils, 2 subsoils).

Soil 1870, Rocky Ford. Collected by agent of the United States Department of Agriculture.

Soils 791, 792, Larimer County. Walter J. Quick, collector.

Prairie (10 soils, 2 subsoils)—Continued.

Soil 3475*, subsoil 3476*, Larimer County; soil 3424, subsoil 3425*, Weld County. W. W. Cooke, collector. These samples represent a large potato-growing district

Soil 1846*, Sedgwick County; soil 1785*, Yuma County. Robert Hay, collector.

Plains marl (3 soils).

Soil 1783*, Yuma County; soils 1844*, 1845*. Robert Hay, collector.

Unclassified (1 soil, 2 subsoils).

Soil 3734, subsoils 3735, 3736, Phillips County. Collected by agents of the United States Department of Agriculture.

CONNECTICUT.

(57 samples.)

The samples from Connecticut were obtained mainly from two sources: Part of them were obtained by agents of this Department and part were collected by the Connecticut and Storrs experiment stations for the soil exhibit of the Columbian Exposition at Chicago.

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil (4 soils, 4 subsoils).

Miscellaneous (3 soils, 2 subsoils).

Soil 794, 1011, subsoil 1012, Falls Village; soil 1073, subsoil 1074, Shaker Station. Collected by the Connecticut and Storrs experiment stations.

Peat swamp (1 soil, 2 subsoils).

Soil 2722, subsoil 2723, 2724, Storrs. Collected by agents of the United States Department of Agriculture.

Drift, glacial (5 soils, 6 subsoils).

Soil 960, subsoil 961, Lebanon; soil 962, subsoil 963, Pomfret; soil 1069, subsoil 1070, Storrs; soil 1117, subsoil 1118, West Cornwall. Collected by the Connecticut and Storrs experiment stations.

Soil 2719, subsoils 2720, 2721, Storrs. Collected by agents, United States Department of Agriculture.

Greenhouse soil—lettuce, cucumbers (1 sample).

Soil 1847*, New Haven.

Tobacco land (cigar type) (12 soils, 9 subsoils).

Soil 1065, subsoil 1066*, Poquonock. Collected by the Connecticut and Storrs experiment station.

Soils 1304, 1938, subsoil 1305*, Bloomfield; soils 728, 831*, 1937, subsoils 729*, 842*, East Hartford; soils 1252, 1362, subsoils 1254*, 1363, Poquonock; soil 1302, subsoil 1303*, Wethersfield; soils 989, 1276, 1939, subsoils 959*, 1277*, Windsor. Collected by agents of the United States Department of Agriculture.

Mechanical analyses of samples 729, 842, 1254 are published in Yearbook, United States Department of Agriculture, 1894, page 146; in Bulletins Nos. 5 and 11, Division of Soils, and in Report of Pennsylvania State College, Part II, 1894, page 144. Mechanical analyses 831, 959, 1066, 1277, 1303, 1305 are published in Bulletin No. 11, Division of Soils, page 40.

Triassic red sandstone (3 soils, 4 subsoils).

Subsoil 1014, New Haven; soil 1061, subsoil 1062, Newington; soil 1015, subsoil 1016, South Manchester; soil 1067, subsoil 1068, Wapping. Collected by the Connecticut and Storrs experiment stations.

Unclassified (5 soils, 4 subsoils).

Soil 1071, subsoil 1072 (hardpan), Newton; soil 1274, subsoil 1275, Silver Lane; soils 1063, 1075, subsoils 1064, 1076, West Hartford. Collected by the Connecticut and Storrs experiment stations.

Unclassified (5 soils, 4 subsoils)—Continued.

Soil 1640* (glass sand, used by Professor Hellriegel and Prof. W. O. Atwater for sand-culture experiments).

Mechanical analysis 1640 is published in Experiment Station Record, Vol. V., No. 8, page 758.

CUBA.

(16 samples.)

The samples from Cuba were collected at the request of the Department by the consul-general at Havana. For the samples from the famous Vuelta Abajo district we are indebted to the courtesy of Mr. Gustavo Bock, of Havana, who placed his agents at the disposal of the Department for the purpose of collecting them. The samples from the eastern part of the island were collected under the direction of the United States vice-commercial agent at Nuevitas.

The samples from the Vuelta Abajo district are said to represent the soil upon which the finest type of Cuban tobacco is produced. It has been shown that these have the same texture as the tobacco soils of Florida and of the Connecticut Valley.

The soils of the Remedios district are much heavier and contain very much more clay. The Remedios tobacco is much heavier and stronger than that from the Vuelta Abajo district. The tobacco soils of Pennsylvania and Ohio are similar in texture to these Remedios soils, and it is noteworthy that the tobacco produced on them is likewise much heavier and stronger than the tobacco on the lighter soils of the Connecticut Valley.

The soils from the eastern districts of Cuba are lighter in texture than the Remedios soils and not unlike those of the Vuelta Abajo district, but for some reasons, at present unknown, the tobacco produced is much heavier and stronger, and but little of it is brought to this country.

[Mechanical analyses have been made of samples marked (*).]

Tobacco land (cigar type) (16 soils).

Soil 1982*, Gibara district; soil 1964*, Marditon de Nuevitas district; soil 6*, Mayari district; soils 1958*, 1959*, 1960*, 1961*, Remedios district; soil 5*, Sagua de Tanamo district; soils 1965*, 1966*, San Miguel de Nuevitas district; soils 306*, 307*, 308*, 309*, 310*, 311*, Vuelta Abajo district.

Mechanical analyses 309, 1960, published in Bulletin No. 5, Division of Soils, page 20. Mechanical analyses 306, 307, 308, 309, 310, 311, 1958, 1959, 1960, 1961, published in Bulletin No. 11, Division of Soils, page 42.

DELAWARE.

(2 samples.)

[Mechanical analyses have been made of samples marked (*).]

Clay, pottery (2 samples).

1968* (china clay), 1975* (china clay), Newcastle County. Contributed by Prof. Edwin Orton.

DISTRICT OF COLUMBIA.

(34 samples.)

The samples from the District of Columbia were all collected by agents of the United States Department of Agriculture and the Maryland Experiment Station.

[Mechanical analyses have been made of samples marked (*).]

Chesapeake (1 soil, 1 subsoil).
Soils 2689, subsoil 2690*.
Clay, brick, and tile (2 samples).
2185*, 2186*.
Columbia (2 soils, 3 subsoils).
Soils 2695, 2703, subsoils 2696*, 2704*, 3791.
Eocene (2 soils, 2 subsoils).
Soils 2691, 2701, subsoils 2692*, 2702*.
Greenhouse soil (2 samples).
1615* (propagating sand), 1616*.
Lafayette (6 soils, 6 subsoils).
Soils 1464, 2685, 2709, 2711, 2713, 2715, subsoils 1465, 2686*, 2710*, 2712*, 2714*, 2716*.
Potomac (2 soils, 4 subsoils).
Soils 2683, 2687, subsoils 2684*, 2688*, 2708*, 3642*.
Unclassified (1 subsoil).
Subsoil 3641.

ENGLAND.

(2 samples.)

[Mechanical analyses have been made of samples marked (*).]

Clay, pottery (1 sample).
1974* (ground Cornwall stone). Contributed by Prof. Edwin Orton.
Fuller's earth (1 sample).
3238*.

FLORIDA.

(179 samples.)

The samples from Florida were collected by agents of this Department. The description of the soils characteristic of the vegetation and the mechanical analyses of the soils have been given in Bulletin No. 13 of this Division. The classification is the same as that in common use in that State and is based mainly upon the character of the growth. The hammock soil, mixed land, and high pine land are adapted to citrus fruits, early truck crops, and tobacco, except that the rich heavy hammock is not a tobacco soil and is adapted to the heavier truck crops only, such as cabbage and potatoes. The flatwoods are not cultivated to any extent, and the Etonia scrub is not cultivated at all at present. The Lafayette forms the tobacco and cotton lands of western Florida with a few exposures on the peninsula. The pineapple lands are at present devoted mainly to this crop.

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil (9 soils, 9 subsoils).
See Muck land.
Clay, pottery (1 sample).
1976* (kaolin). Contributed by Prof. Edwin Orton.

Cotton (4 soils, 7 subsoils).

See Lafayette.

Etonia scrub—not cultivated, desert plants (4 soils, 5 subsoils).

Soils 1621*, 2913*, 2915*, 2917*, subsoils 1622*, 2914*, 2916*, 2918*, 2919 (Lafayette from under scrub), Lake County.

Mechanical analysis 1622, published in Yearbook, Department of Agriculture, 1894, page 136. Mechanical analyses 1621, 1622, 2913, 2914, 2915, 2916, 2917, 2918, published in Bulletin No. 13, Division of Soils, page 29.

Flatwoods (2 soils, 1 subsoil).

Soil 3632 (alkali), Bradford County; soil 1659, subsoil 1660, Orange County.

Fuller's earth (11 samples).

2903 (crude), 2904* (coarsely ground for refining oil and vaseline), 2905 (fine), 3967 (crude), 3968 (grade cm), 3969 (grade S), 3970 (grade F), 3971 (grade XXS), 3972 (grade XXF), 3973 (grade XF), 3974 (dust), Gadsden County.

Hammock (28 soils, 31 subsoils).

Grey hammock—citrus fruits, truck, tobacco (16 soils, 14 subsoils).

Soils 2857*, 2859*, subsoils 2858*, 2860*, Brevard County; soil 2935*, subsoil 2936*, Dade County; soils 1953, 1954, 1956, 3688, 3692, subsoils 3689, 3690, 3691, Lake County; soils 2817*, 2819*, 2820*, 2947, 3633*, subsoils 2818*, 2821*, 2948, 3631*, Polk County; soils 3627, 3687, subsoils 3624, 3625, 3626, 3628, Putnam County; soil 3623, Volusia County.

Mechanical analyses 2817, 2818, 2819, 2820, 2821, 2857, 2858, 2859, 2860, published in Bulletin No. 13, Division of Soils, page 29. Mechanical analyses 2817, 2818, 2819, 2820, 2821, published in Bulletin No. 11, Division of Soils, pages 41 and 42.

Light hammock—citrus fruits, truck, tobacco (4 soils, 7 subsoils).

Soils 2827*, 2830*, subsoils 2828*, 2829*, 2831*, 2847*, 2848, Marion County; soils 2871*, 2873*, subsoils 2872*, 2874*, Polk County.

Mechanical analyses 2827, 2829, 2830, 2831, 2847, 2871, 2872, 2873, 2874, published in Bulletin No. 13, Division of Soils, pages 28 and 29. Mechanical analyses 2827, 2828, 2830, 2831, 2847, published in Bulletin No. 11, Division of Soils, pages 41 and 42.

Mulatto hammock—citrus fruits, truck, tobacco (1 soil, 1 subsoil).

Soil 2822*, subsoil 2823*, Polk County.

Mechanical analyses 2822, 2823, published in Bulletin No. 11, Division of Soils, page 41; also published in Bulletin No. 13, Division of Soils, page 30.

Red coquina hammock—citrus fruits, truck (2 soils, 2 subsoils).

Soils 2861*, 2863*, subsoils 2862*, 2864*, Brevard County.

Mechanical analyses 2861, 2862, 2863, 2864, published in Bulletin No. 13, Division of Soils, pages 29 and 30.

Rich heavy hammock—citrus fruits, truck (5 soils, 7 subsoils).

Soils 1625*, 2881, 2884*, subsoils 1626*, 2882, 2883*, 2885*, Lake County; soils 2832*, 2834*, subsoils 2833*, 2835*, 2836*, Marion County.

Mechanical analyses 1625, 2832, 2834, published in Bulletin No. 13, Division of Soils, page 31.

High pine land—citrus fruits, truck, tobacco (18 soils, 19 subsoils).

Soil 2939*, subsoil 2940*, Dade County; soils 1619*, 1623*, 1992, 1993, 1994, 2869*, 2906*, 2908*, 2911*, subsoils 1620*, 1624*, 2870*, 2907*, 2909*, 2912*, 3693, 3694, Lake County; soils 2824* (first quality, considered as productive as the hammock), 2826* (third quality, very poor), 2875*, 2877, 2879* (third quality), 2850*, 2852*, 2854, subsoils 2825* (first quality, considered as productive as the hammock), 2851*, 2853*, 2855, 2876*, 2878*, 2880* (third quality), 2920* (third quality), 3629*, 3630*, Polk County.

High pine land—citrus fruits, truck, tobacco (18 soils, 19 subsoils)—Continued.

Mechanical analyses 1620, 1624, published in Yearbook, Department of Agriculture, 1894, page 136. Mechanical analyses 2824, 2825, 2826, 2850, 2851, 2852, 2853, published in Bulletin No. 11, Division of Soils, pages 41, 42. Mechanical analyses 1619, 1620, 1623, 1624, 2824, 2825, 2826, 2850, 2851, 2852, 2853, 2869, 2870, 2875, 2876, 2879, 2880, 2906, 2907, 2908, 2909, 2911, 2912, 2920, published in Bulletin No. 13, Division of Soils, page 30. Mechanical analysis 1620 also published in Bulletin No. 129, North Carolina Experiment Station, 1896, page 174.

Lafayette (red lands)—tobacco, cotton (4 soils, 7 subsoils).

Soils 2894*, 2897*, 2899*, 2901*, subsoils 2895*, 2896*, 2898*, 2900*, 2902*, Gadsden County (tobacco and cotton lands of western Florida); subsoil 2910*, Lake County; subsoil 2856, Polk County.

Mechanical analyses 2894, 2895, 2896, 2897, 2898, 2899, 2900, 2901, published in Bulletin No. 11, Division of Soils, page 42; also in Bulletin No. 13, Division of Soils, page 29.

Mixed land (pine and red oak)—citrus fruits, truck, tobacco (4 soils, 6 subsoils).

Soils 2837*, 2839*, 2842*, 2845*, subsoils 2838*, 2840*, 2841*, 2843*, 2844, 2846*, Marion County.

Mechanical analyses 2837, 2838, 2839, 2840, 2841, 2842, 2843, 2845, 2846, published in Bulletin No. 11, Division of Soils, pages 41, 42; also in Bulletin No. 13, Division of Soils, pages 30, 31.

Muck land (alluvium)—sugar cane, rice, truck crops (9 soils, 9 subsoils).

Soils 2812*, 2813*, 2892, 2932*, 2934, subsoils 2893, 2933*, Dade County; soils, 1942*, 1945*, 1946*, 1950*, subsoils 1943*, 1944*, 1947*, 1948, 1949, 1951*, 1952*, Osceola County.

Pineapple land (4 soils, 6 subsoils).

Soils 2212*, 2886*, 2888*, 2890*, subsoils 2213*, 2214*, 2887*, 2889*, 2891*, 3965*, Dade County.

Mechanical analyses 2212, 2213, 2214, 2886, 2887, 2888, 2889, 2890, 2891, published in Bulletin No. 13, Division of Soils, page 28.

Spruce pine scrub—truck and second quality orange soil (3 soils, 3 subsoils).

Soils 2865*, 2867*, subsoils 2866*, 2868, Brevard County; soil 2941*, subsoil 2942*, Dade County.

Mechanical analyses 2865, 2866, 2867, published in Bulletin No. 13, Division of Soils, page 28.

Tobacco land (cigar type)—(47 soils, 54 subsoils).

See Hammock, high pine land, mixed land, Lafayette.

Truck land (53 soils, 59 subsoils).

See Hammock, high pine land, mixed land, spruce pine scrub.

Unclassified (2 soils, 2 subsoils).

Soils 2937*, 2938*, Dade County; subsoil 1955, Lake County; subsoil 2849*, Marion County.

GEORGIA.

(1 sample.)

Only one sample from Georgia is contained in the collection.

[Mechanical analysis has been made of sample marked (*).]

Unclassified (1 soil).

Soil 2315*, Bibb County.

GERMANY.

(7 samples.)

The samples from Germany were collected by W. T. Swingle from near Geisenheim on the Rhine, as representing the best wine soils of the Geisenheim district. The soil is derived from a clay slate of the

Devonian age, the undecomposed Thonschiefer (clay slate) being found from 15 to 18 feet below the surface. This is quarried and applied to the surface as a top dressing, where it entirely disintegrates and mixes with the soils within two or three years. Immediately under the soil and overlying the Thonschiefer is a clay marl (Thonmergel), which is applied to the surface as an annual dressing, particularly where the Thonschiefer can not be obtained. These applications to the soil are considered essential for the finest bouquet and aroma in the wine.

[Mechanical analyses have been made of samples marked (*).]

Vineyard soils (4 soils, 3 subsoils).
Soils 3874*, 3875*, 3876*, 3880*, subsoils 3877 (undecomposed Thonschiefer), 3878 (Thonschiefer partly weathered, as applied to vineyards), 3879* (Thonmergel).

HAWAIIAN ISLANDS.

(12 samples.)

[Mechanical analyses have been made of samples marked (*).]

Volcanic ash lava, scoria (12 soils).
Soils 3611*, 3612*, 3613*, 3614*, 3615*, 3616*, 3617*, 3618*, 3619*, 3620*, 3621*, 3622*. A. B. Lyon, collector.

IDAHO.

(3 samples.)

[Mechanical analysis has been made of sample marked (*).]

Basalt—wheat (1 soil, 1 subsoil).
Soil 3303, subsoil 3304, Latah County. Collected by agent of the United States Department of Agriculture.
Unclassified (1 sample).
3682*, Kootenai County. J. B. Leiberg, collector.

ILLINOIS.

(71 samples.)

Most of the samples from Illinois were collected by Mr. Frank Leverett at the time he was making the collection of typical Illinois soils for the World's Fair Exposition at Chicago. The character of the formations is fully discussed in the Report of the Illinois Board of the World's Fair Commissioners, published in 1893.

[Mechanical analyses have been made of samples marked (*).]

Corn land (41 soils, 22 subsoils).
See Glacial drift, loess, prairie, Subcarboniferous.
Glacial drift—wheat, corn (12 soils, 3 subsoils).
Bowlder clay (1 soil, 2 subsoils).
Soil 1334*a**, Coles County; subsoil 1488, Rock Island; subsoil 1432, Winnebago County. Frank Leverett, collector.
Miscellaneous (11 soils, 1 subsoil).
Soil 1322, Bond County; soil 1344*, subsoil 1350, Christian County; soil 1369* (prairie), Clark County; soil 1339* (prairie), Cook County; soil 1364, Dekalb County; soil 1346*, Effingham County; soil 1333* (prairie), Marshall County; soils 1326, 1327* (prairie), Mason County; soil 1338,* Peoria County; soil 1335, Saline County. Frank Leverett, collector.
Mechanical analyses 1327, 1333, 1334*a*, 1338, 1339, 1344, 1346, 1369, published in Report of Illinois Board of World's Fair Commissioners, 1893, pages 103–106.

Greenhouse soil—carnations, roses (1 sample).

Soil 2231*.

Loess—timber lands, corn, wheat (23 soils, 14 subsoils).

Subsoil 1323, Bond County; soils 1315*, 1317*, subsoils 1316*, 1318*, Cass County; soil 1307*, subsoil 1308*, Greene County; soil 1345*, Jefferson County; soil 1347*, Jo Daviess County; soil 1330, Johnson County; soil 1311, subsoils 1312*, 1349, Madison County; soil 1368*, Rock Island; soil 1343*, Shelby County; soil 1337, Williamson County; soil 1332*, Winchester County. Frank Leverett, collector.

For additional samples of loess, *see* under Prairie.

Mechanical analyses 1316, 1317, published in Monthly Weather Review, January, 1895, page 17; in Rocks, Rock Weathering, and Soils, page 331; 1317 also published in Bulletin No. 5, Division of Soils, page 12. Mechanical analyses 1307, 1308, 1312, 1315, 1316, 1317, 1318, 1332, 1343, 1345, 1347, 1368, published in Report of Illinois Board of World's Fair Commissioners, 1893, pages 104–105.

Prairie—corn, wheat (20 soils, 11 subsoils).

Gumbo (1 soil).

Soil 1340*, St. Clair County. Frank Leverett, collector.

Limestone, Galena (1 soil).

Soil 1325*, Jo Daviess County.

Loess (12 soils, 8 subsoils).

Soil 1321*, Bond County; subsoil 2808*, Cass County; soil 1342*, Cumberland County; soil 1331, Greene County; subsoil 1370*, Henderson County; soil 1319, subsoil 1320, Madison County; soil 1309, subsoils 1310, 1348, 1373, Montgomery County; soil 1324, Rohley; soil 1306*, Saline County; soil 1365, subsoil 1366, Sangamon County; soil 1313, subsoil 1314, Shelby County; soil 1328*, Stark County; soil 1336, Stephenson County; soil 1367, Union County. Frank Leverett, collector.

Unclassified (2 soils, 3 subsoils).

Soils 299, 300, subsoils 301, 302*, 3966*, Champaign County. Collected by the Illinois Experiment Station.

For additional samples of prairie, *see* Glacial drift.

Mechanical analyses 302, 1306, 1321, 1325, 1328, 1340, 1342, 1370, published in Report of the Illinois Board of World's Fair Commissioners, 1893, pages 103–106.

Subcarboniferous—corn, wheat (2 soils, 2 subsoils).

Soils 1374, 1376, subsoils 1375, 1377, Union County. Frank Leverett, collector.

Truck land (2 soils, 2 subsoils).

Soils 2323, 2327, subsoils 2324*, 2328*, Kankakee County. Collected by Dr. Clarke Gapen from the irrigated fields of the grounds of the Illinois Eastern Hospital.

Unclassified (2 soils, 1 subsoil).

Soil 1371, Montgomery County. Frank Leverett, collector.

Soil 2325, subsoil 2326*, Kankakee County. Collected by Dr. Clarke Gapen from the irrigated fields of the grounds of the Illinois Eastern Hospital.

Wheat land (41 soils, 22 subsoils).

See Glacial drift, loess, prairie, Subcarboniferous.

INDIANA.

(4 samples.)

[Mechanical analyses have been made of samples marked (*).]

Greenhouse soil—carnations, roses (2 samples).

Soil 2232*, Kokomo; soil 2246*, Lafayette.

Wind-blown dust (2 samples).

1957*, Parke County; 1995 (38 samples of wind-blown dust, or "black snow," which fell during January and February, 1895, in several counties in Indiana are filed under this number).

Mechanical analysis 1957, published in Monthly Weather Review, January, 1895, page 17; also in Rocks, Rock-Weathering, and Soils, page 331.

IOWA.

(12 samples.)

[Mechanical analyses have been made of samples marked (*).]

Corn land (2 subsoils).

See Loess.

Gumbo (7 subsoils).

Subsoils 2330*, 2332*, 2333*, 2335, 2338*, Lee County; subsoil 2329, Louisa County; subsoil 2336*, Washington County. Frank Leverett, collector.

Loess—corn, wheat (2 subsoils).

Subsoil 2339*, Lee County. Frank Leverett, collector.

Subsoil 2542, Muscatine County. Selected by Dr. Diller as typical of the loess.

Described in Bulletin No. 150 of the United States Geological Survey, and forming one of the Educational Series of Rocks, recently issued by the Survey.

Unclassified (3 subsoils).

Subsoil 2331*, Lee County; subsoil 2334*, Muscatine County; subsoil 2337*, Washington County. Frank Leverett, collector.

Wheat land (2 subsoils).

See Loess.

KANSAS.

(119 samples.)

The samples from Kansas were obtained through two agencies. Part of them were collected and sent in by Mr. Robert Hay, in connection with his work for the United States Geological Survey. The others were collected by agents of this Department. These samples are quite typical of the localities they represent, and there are several well-marked types which show very interesting relations between soils and crops. The samples are accompanied by very full notes as to the origin and as to their agricultural value and any peculiarities in regard to their physical properties.

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil—corn (2 soils, 1 subsoil).

Soil 402, Barton County; soil 455, subsoil 456, Cloud County. Collected by agents of the United States Department of Agriculture.

Corn land (39 soils, 32 subsoils).

See Alluvial soil, prairie.

Prairie (56 soils, 46 subsoils).

Alkali soil (1 soil).

Soil 1778*, Sherman County. Robert Hay, collector.

Benton limestone—corn (6 soils, 6 subsoils).

Soil 427, subsoil 428*, Ellis County; soil 451, subsoil 452*, Jewell County; soil 445, subsoil 446, Lincoln County; soil 453, subsoil 454, Mitchell County; soil 660, subsoil 661, Osborne County; soil 396, subsoil 397*. Collected by agents of the United States Department of Agriculture.

Prairie (56 soils, 46 subsoils)—Continued.

Black waxy soil (1 subsoil).

Subsoil 323*, Sumner County. Collected by agents of the United States Department of Agriculture.

Blue-stem soil (3 soils, 2 subsoils).

Soil 1775*, Sherman County. Robert Hay, collector.

Subsoil 403*, Barton County; subsoil 399*, Meade County; soil 429, 430*, Stafford County. H. R. Hilton, collector.

Dakota sandstone—corn (2 soils, 1 subsoil).

Soil 1611. Robert Hay, collector.

Soil 447, subsoil 448, Dickinson County. Collected by agents of the United States Department of Agriculture.

Gumbo (4 soils).

Soils 1940, 1941, Shawnee County; soils 1962, 1963, Sumner County. Collected by agents of the United States Department of Agriculture.

Gypsum soil (1 soil, 2 subsoils).

Soil 1690, subsoil 1885, Logan County; subsoil 407, Pratt County. Collected by agents of the United States Department of Agriculture.

Loess—corn (2 soils, 1 subsoil).

Soil 1609, Geary County. Robert Hay, collector.

Soil 3737, subsoil 3738, Cheyenne County. Collected by agents of the United States Department of Agriculture.

Magnesia soil (1 subsoil).

Subsoil 1793. Robert Hay, collector.

Plains marl—corn (15 soils, 8 subsoils).

Soil 1789*, Cheyenne County; soil 1612, Saline County; soil 1784*, Sherman County; soils 1776*, 1781*, Wallace County; soils 1782,* 1786*, localities unknown. Robert Hay, collector.

Soil 404, subsoil 405*, Ford County; soil 433, subsoils 434, 435, Logan County; soil 398, Meade County; soil 439, subsoil 440*, Norton County; soil 441, subsoil 442*, Phillips County; soil 425, subsoil 426*, Russell County; soil 400, subsoil 401*, Scott County; soil 431, subsoil 432*, Thomas County. Collected by agents of the United States Department of Agriculture.

Mechanical analysis 1789 published in Bulletin No. 5, Division of Soils, page 14.

Salt-grass land (1 soil, 1 subsoil).

Soil 1688, subsoil 1689, Finney County. Collected by agents of the United States Department of Agriculture.

Unclassified (21 soils, 23 subsoils).

Corn land (12 soils, 15 subsoils).

Soils 1678, 1682, subsoils 1679*, 1683*, 1684*, 1685*, Finney County; soil 1472, subsoil 1473, McPherson County; soil 324, subsoils 325*, 326*, Reno County; soil 1887, Rooks County; soils 1691*, 1692*, subsoil 1693*, Russell County; subsoil 1610, Saline County; soils 1694, 1698, 1884, subsoils 1695*, 1696, 1697, 1699*, 1877, Scott County; soil 1606*, subsoil 1607*, Shawnee County; soil 1886, Trego County. Collected by agents of the United States Department of Agriculture.

Miscellaneous (9 soils, 8 subsoils).

Soil 1777, Wallace County. Robert Hay, collector.

Soil 1882, subsoil 1883, Allen County; subsoil 3978 (zinc clay sulphide), Cherokee County; soil 1680, subsoils 1681*, 1686* (water-bearing sand and gravel from well at Garden City), Finney County; subsoil 409*, Meade County (sand from which artesian flow is obtained in this locality); subsoil 410, Ness County; soil 406, subsoil 408*, Pratt County; soils 1608, 1700, 1888, 1889, subsoil 1701*, Shawnee County; soil 322, Sumner County. Collected by agents of the United States Department of Agriculture.

Sand Hills (3 soils, 3 subsoils).

Soils 1672, 1674, 1676, subsoils 1673, 1675*, 1677*, Finney County. Collected by agents of the United States Department of Agriculture.

Sedentary soil (4 soils).

Soils 1779*, 1791*, Cheyenne County; soil 1780, Wallace County; soil 1790. Robert Hay, collector.

Silt from irrigation ditch (1 sample).

1687*, Finney County. Collected by agents of the United States Department of Agriculture.

Volcanic ash (1 soil, 2 subsoils).

Soil 1792*, Trego County. Robert Hay, collector.

Subsoils 1474, 1618, McPherson County. J. A. Udden, collector.

KENTUCKY.

(185 samples.)

The samples from Kentucky were collected in part by the Kentucky Experiment Station, in connection with the soil exhibit of that State, for the Columbian Exposition at Chicago. The remaining samples were collected by agents of this Department, principally for a study of the tobacco soils of the State.

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil—corn, export tobacco (4 soils, 4 subsoils).

Soils 3202, 3210, subsoils 3203, 3211, Graves County; soils 2961, 2963, subsoils 2962*, 2964*, Nicholas County. Collected by agents of the United States Department of Agriculture.

Clay, pottery (1 sample).

1972* (crude ball clay), Graves County. Contributed by Prof. Edwin Orton.

Coal measures—wheat, corn, grass (1 soil, 1 subsoil).

Soil 1059, subsoil 1060, Boyd County. Collected by the Kentucky Experiment Station.

Corn land (80 soils, 92 subsoils).

See Alluvial soil, coal measures, Carboniferous, Keokuk, St. Louis group, Trenton limestone, Post-Tertiary, Upper Silurian.

Devonian black slate—glades (8 soils, 2 subsoils).

Soil 1094, subsoil 1095, Montgomery County. Collected by the Kentucky Experiment Station.

Soils 3467*, 3468*, 3469*, 3470*, 3472*, 3473*, 3474*, subsoil 3471*, Madison County. S. C. Mason, collector.

Grass land (63 soils, 75 subsoils).

See Coal measures, Carboniferous, Keokuk, St. Louis group, Trenton limestone, Upper Silurian.

Limestone (61 soils, 73 subsoils).

Carboniferous—export tobacco, grass, wheat, corn (9 soils, 11 subsoils).

Soil 1104, subsoil 1105*, Hopkins County. Collected by the Kentucky Experiment Station.

Soils 3220, 3222, 3224, 3226, 3229, 3231, 3233, 3235, subsoils 3221, 3223, 3225*, 3227*, 3228, 3230, 3232*, 3234, 3236, 3237, Henderson County. Collected by agents of the United States Department of Agriculture.

Mechanical analyses 1105, 3225, 3227, 3232, published in Bulletin No. 11, Division of Soils, pages 45–47.

Keokuk (Lower Subcarboniferous)—export tobacco, grass, wheat, corn (1 soil, 1 subsoil.)

Soil 1378, subsoil 1379*, Allen County. Collected by the Kentucky Experiment Station.

Limestone (61 soils, 73 subsoils)—Continued.

Keokuk (Lower Subcarboniferous)—export tobacco, grass, wheat, corn (1 soil, 1 subsoil)—Continued.

Mechanical analysis 1379 published in Bulletin No. 11, Division of Soils, page 46.

St. Louis group of the Subcarboniferous ("rich barrens")—export tobacco, grass, wheat, corn (25 soils, 30 subsoils).

Soils 1098, 3158*, 3160, 3162, 3164, 3166, 3168, 3170, 3172, 3174, 3176, 3178, 3180, 3182, subsoils 1099*, 3159*, 3161, 3163, 3165, 3167, 3169*, 3171*, 3173, 3175, 3177, 3179, 3181, 3183, 3994, Christian County; soils 3142, 3144, subsoils 3143, 3145, Logan County; soil 3140, subsoil 3141, Simpson County; soils 1430, 3122, 3124, 3127, 3129, 3131, 3133, 3135*, subsoils 1431*, 3123, 3125, 3126, 3128*, 3130, 3132, 3134*, 3136*, 3137*, 3138*, 3139*, Warren County. Collected by agents of the United States Department of Agriculture.

Mechanical analyses 1431, 3128, 3134, 3135, 3136, 3137, 3138, 3139, 3158, 3159, 3169, 3171, published in Bulletin No. 11, Division of Soils, pages 44–47. Mechanical analysis 1099, published in Bulletin No. 5, Division of Soils, page 22; also in Bulletin No. 3, Division of Soils, page 10.

Trenton and Hudson River limestone (Lower Silurian-Blue-grass region)—grass, wheat, corn, White Burley tobacco (26 soils, 31 subsoils).

Soils 3072*, 3074, 3076, 3080*, subsoils 3073*, 3075, 3077*, Bracken County; soils 1848, 1850, 1852, subsoils 1849*, 1851*, 1853*, Clark County; soils 1990, 2579, 2582, 2584, 2587, subsoils 1927*, 1991*, 2580*, 2581*, 2583*, 2585*, 2586*, 2588*, 2589*, Fayette County; soil 3066, subsoil 3067, Fleming County; soils 2956, 2958, 3068, 3070*, 3078, subsoils 2957*, 2959*, 2960*, 3069*, 3071*, 3079, Mason County. Collected by agents of the United States Department of Agriculture.

Soils 130*, 277*, 285, 295*, 1017, 1102, 1604, subsoils 287*, 296*, 297*, 298*, 1018*, 1103, 1702*, 1933, Fayette County; soil 1100, subsoil 1101*, Montgomery County. Collected by the Kentucky Experiment Station.

Mechanical analyses 287, 1101, 1702, 1849, 1851, 1853, 1927, 2580, 2581, 2583, 2585, 2586, 2588, 2589, 3069, 3070, 3071, 3072, 3073, 3077, 3080, 2957, 2959, 2960, published in Bulletin No. 11, Division of Soils, pages 44–45. Mechanical analysis 287, published in Bulletin No. 3, Division of Soils, page 10; also in Bulletin No. 5, Division of Soils, page 22.

Post-Tertiary—export tobacco, wheat, corn (13 soils, 13 subsoils).

Soils 3190, 3192, 3194, subsoils 3191, 3193, 3195, Calloway County; soils 3198, 3200, 3204, 3206, 3208, 3312, 3214, 3216, 3218, subsoils 3199, 3201, 3205, 3207, 3209*, 3213, 3215*, 3217*, 3219, Graves County; soil 3196, subsoil 3197*, McCracken County. Collected by agents of the United States Department of Agriculture.

Mechanical analyses 3197, 3209, 3215, 3217, published in Bulletin No. 11, Division of Soils, pages 46 and 47.

Silurian, Upper—wheat, corn, grass (1 soil, 1 subsoil).

Soil 1096, subsoil 1097, Montgomery County. Collected by the Kentucky Experiment Station.

Tobacco land (78 soils, 90 subsoils).

Export (52 soils, 59 subsoils).

See Alluvial soil, Carboniferous, Keokuk, St. Louis group, Post-Tertiary.

White Burley (26 soils, 31 subsoils).

See Trenton limestone.

Waverly sandstone (Lower Subcarboniferous—"white-oak land") (1 soil, 1 subsoil).

Soil 1294, subsoil 1295, Lewis County. Collected by the Kentucky Experiment Station.

Wheat land (74 soils, 86 subsoils).

See Carboniferous, Keokuk, St. Louis group, Trenton limestone, Post-Tertiary.

LOUISIANA.

(236 samples.)

The samples from Louisiana were collected and sent in by Prof. W. W. Clendenin, of the Louisiana geological survey, and Dr. W. C. Stubbs, director of the Louisiana experiment station. The mechanical analyses were made in the Division of Soils, by Mr. E. S. Matthews, for the Louisiana geological survey.

[Mechanical analyses have been made of samples marked (*)].

Acadia clays (2 soils).
 Soils 1454, 1455, Ouachita Parish.
Alluvial soil—sugar cane, cotton, corn (32 soils, 7 subsoils).
 Mississippi alluvium (23 soils, 2 subsoils).
  Soils 2487*, 2490*, 2491*, 2492*, 2493*, Ascension Parish; soils 1499*, 1500*, 2529*, 2530*, 2536*, 2537*, 2538*, 2539*, 2540*, 2541*, 3962*, Audubon Park; soils 2531*, 2532*, 2533*, 2534*, 2535*, East Carroll Parish; soils 2422*, 2424*, subsoils 2423*, 2425, Pointe Coupee Parish.
 Red River alluvium (9 soils, 5 subsoils).
  Soil 2359*, subsoil 2360*, Avoyelles Parish; soil 1443, subsoil 1444*, Natchitoches Parish; soils 2357*, 2504*, 2505*, 2506*, subsoil 2358*, Rapides Parish; soil 2503*, St. Landry Parish; soils 1505, 1507, subsoils 1506*, 1508*, localities unknown.
Bluff land—cotton, sugar cane, corn (22 soils, 19 subsoils).
 Soils 2517*, 2519* ("crayfish land"), 2420*, subsoils 2518*, 2520* ("crayfish land"), 2421, East Baton Rouge Parish; soils 2399*, 2401, 2403, 2405, 2407, 2409, 2411, 2413*, 2415*, 2417*, 2470, 2472*, 2486*, 2526*, subsoils 2400*, 2402*, 2404, 2406, 2408*, 2419*, 2471, 2473*, East Feliciana Parish; soils 2465, 2469, subsoil 2466, Lafayette Parish; subsoil 2500*, St. Martins Parish; soils 2397*, 2474*, subsoil 2398*, St. Landry Parish; subsoils 2410, 2412*, 2414*, 2416*, 2418*, West Feliciana Parish; soil 2494, locality unknown.
Corn land (94 soils, 63 subsoils).
 See Alluvial soil, bluff land, prairies.
Cotton land (117 soils, 74 subsoils).
 See Alluvial soil, bluff land, Lafayette, long-leaf pine hills, prairies.
Cretaceous (1 soil, 1 subsoil).
 Soil 1449, subsoil 1450*, Winn Parish.
Drift (4 soils).
 Soils 1441, 1442, Natchitoches Parish; soils 1445, 1453, Ouachita Parish.
Hammock (1 soil, 1 subsoil).
 Soil 2437, subsoil 2438*, Calcasieu Parish.
Lafayette (orange sands)—cotton (5 soils, 3 subsoils).
 Soil 1462*, subsoil 1463*, Homer, Claiborne Parish; soil 1460, subsoil 1461*, Hughes Spur, Bossier Parish; soils 1451, 1452, subsoil 1446, Ouachita Parish; soil 1458*, Webster Parish.
Long-leaf pine flats (4 soils, 2 subsoils).
 Soils 2439, 2441, subsoils 2440*, 2442*, Calcasieu Parish; soil 2521*, St. Tammany Parish; soil 2522*, Washington Parish.
Long-leaf pine hills—cotton (18 soil, 8 subsoils).
 Soils 2436, 2445, subsoil 2446, Calcasieu Parish; soil 2351*, subsoil 2352, Natchitoches Parish; soils 2343*, 2353*, 2355*, subsoils 2344*, 2354*, 2356*, Rapides Parish; soils 2341*, 2342*, 2361*, 2364*, St. Landry Parish; soil 2527* ("dead land"), 2528* ("good land"), Tangipahoa Parish; soil 2523*, Tensas Parish; soils 2345*, 2347* ("hogwallow land"), 2349*, subsoils 2346, 2348* ("hogwallow land"), 2350*, Vernon Parish; soils 2524*, 2525*, Washington Parish.

Prairies—sugar cane, cotton, rice, corn (40 soils, 37 subsoils).

Black prairie ("buckshot land") (9 soils, 5 subsoils).

Soils 2496*, 2501*, subsoil 2428, Iberia Parish; soils 2463, 2467, subsoils 2464, 2468, Lafayette Parish; soil 2453, subsoil 2454, St. Landry Parish; soils 2475, 2498*, 2499*, St. Martin Parish; soil 2497*, subsoil 2495, between Bayous Tortu and Teche.

Calcasieu (3 soils, 3 subsoils).

Soils 2381, 2383, 2385, subsoils 2382, 2384, 2386, Calcasieu Parish.

Faquataique (1 soil, 1 subsoil).

Soil 2393, subsoil 2394, St. Landry Parish.

Pine Prairie (1 soil, 1 subsoil).

Soil 2365*, subsoil 2366*, St. Landry Parish.

Plaquemine (3 soils, 3 subsoils).

Soils 2373, 2375, subsoils 2374, 2376, Acadia Parish; soil 2395, subsoil 2396, St. Landry Parish.

Prairie Marmou (4 soils, 4 subsoils).

Soils 2367*, 2369*, ("flat rice lands"), 2391, 2451, subsoils 2368*, 2370*, ("flat rice lands"), 2392, 2452, St. Landry Parish.

Prairie Swallow (3 soils, 3 subsoils).

Soils 2387, 2389, 2449, subsoils 2388, 2390, 2450, Calcasieu Parish.

Miscellaneous (16 soils, 17 subsoils).

Soils 2377, 2379, 2455, 2457, subsoils 2378, 2380, 2456, 2458, Acadia Parish; soils 2426*, 2429, 2432, 2434, 2447, subsoils 2427*, 2430, 2431, 2433, 2435, 2448, Calcasieu Parish; soils 1447, 2477, 2479*, subsoils 1448, 2478, 2480*, 2481*, Iberia Parish; soil 2461, subsoil 2462, Lafayette Parish; soil 2485, Orleans Parish; soil 2459, subsoils 2460, 2502*, St. Landry Parish; soil 2476, St. Martin Parish.

Rice land (40 soils, 37 subsoils).

See Prairie.

Sugar-cane land (94 soils, 63 subsoils).

See Alluvial soil, bluff land, prairie.

Tobacco land (6 soils, 6 subsoils).

Cigarette (1 soil, 1 subsoil).

Soil 752*, subsoil 765, Ouachita Parish.

Perique tobacco, sugar cane (5 soils, 5 subsoils).

Soils 2928*, 2930*, subsoils 2929*, 2931*, St. Charles Parish; soil 2922*, subsoil 2923*, St. James Parish; soils 2924*, 2926*, subsoils 2925*, 2927*, St. Johns Parish.

Unclassified (11 soils, 6 subsoils).

Soil 2371*, subsoil 2372*, Acadia Parish; soil 2443, subsoil 2444, Calcasieu Parish; soils 1501, 1503, subsoils 1502*, 1504, Rapides Parish; soils 2488*, 2489*, Ouachita Parish; soil 1456, subsoil 1457, Hughes Spur, Bossier Parish; soil 2363*, subsoil 2362*, St. Landry Parish; soils 2482, 2483, 2484, Jeffersons Island.

MARYLAND.

(1,023 samples.)

The samples from Maryland were collected by agents of this Department and the Maryland Experiment Station.

Maryland is divided into three great physiographic divisions. The coastal plains, forming southern Maryland and the Eastern Shore, are composed of unconsolidated materials. The principal formations are the Chesapeake, which forms the heaviest and best wheat lands; the Lower Columbia, which forms very fertile terraces along the Potomac River; the Upper Columbia, which constitutes the very valuable truck

lands along the Chesapeake Bay; the Eocene, which is used both for truck and small fruits; the Lafayette, which covers the high lands and forms extensive pine barrens in southern Maryland; and the Potomac formation, which adjoins the Piedmont Plateau. The Potomac formation is characterized by a great variation in the texture of the soils, ranging from coarse sands to variegated clays almost impervious to water. The wheat and tobacco lands of the Chesapeake formation are interesting, as they are derived from the diatomaceous earth. These beds are of great thickness, but where they are exposed to the weather the loose white material quickly breaks down into a light yellow clay. The soils and subsoils of these tobacco and wheat lands, as a rule, show many diatoms still in perfect form.

These formations all occur on the Eastern Shore, but at the present time the geological correlation has not been worked out in sufficient detail for a basis for the classification of the soils.

The Piedmont Plateau, forming central Maryland, consists principally of the following formations: The larger part of the area is derived from gneiss or phillite (hydromica-schist). Gabbro and gneiss occur in smaller areas. The soils of all these areas are strong clay lands, well adapted to wheat, grass, corn, to all lines of general farming, and to dairy interests. Serpentine occurs in small areas, forming bare and unproductive hills. Quartzite forms two or three ridges which have at present no agricultural value. A few small valleys of fertile limestone soils exist also in this area.

The mountain region west of the Piedmont Plateau is made up of limestones, sandstones, and shales. The principal formations are the Trenton limestone, forming the fertile valleys around Hagerstown and Frederick, which may be considered the highest types of lands for general agricultural purposes; the Triassic red sandstone; the Catskill and Helderberg, which cover large areas adapted to general farming and the heavier agricultural crops; the Hamilton-Chemung forms extensive valleys, giving moderately good pasturage for stock. The remaining formations are mainly mountainous or in such small areas as to be unimportant from an agricultural standpoint.

The general character of these different types of soils has been worked out and described in Bulletin No. 4, of the United States Weather Bureau, and in several of the reports of the Maryland Experiment Station.

[Mechanical analyses have been made of samples marked (*). Chemical analyses have been made of samples marked (°).]

Alluvial soil—corn, wheat (3 soils, 2 subsoils).

Soils 3486, 3594, 3596; subsoils 3595,* 3597,* Allegany County.

Cambrian sandstone—mountain peach belt (9 soils, 10 subsoils).

Soils 938, 940, 942, 944, 2743, 3890, 3892, 3894, 3915, subsoils 939*, 941*, 943*, 945*, 946* 2744*, 3891, 3893, 3895, 3916, Washington County.

Mechanical analyses, 939, 941, 943, 945, published in Bulletin No. 29, Maryland Experiment Station, page 172.

Catoctin granite and schist (10 soils, 12 subsoils).

Granite (7 soils, 9 subsoils).

Soils 241, 244, subsoils 242*, 243, Frederick County; soils 3896, 3902, 3904, 3909, 3912, subsoils 3897, 3903, 3905, 3906, 3910, 3911, 3913, Washington County.

Schist (3 soils, 3 subsoils).

Soils 3898, 3900, 3907, subsoils 3899, 3901, 3908, Washington County.

Catskill red sandstone—grass, wheat, corn (20 soils, 25 subsoils).

Soils 238*, 896, 3521*, subsoils, 897*, 898*, 899*, 900*, 902*, 903*, 3522*, Allegany County; soils 2170*, 2172*, 2174*, 2176*, 2178*, 2180*, 3523*, 3525, 3527, 3530, 3532, 3534*, 3714, 3716, 3718, 3720, 3722, subsoils 2171*, 2173*, 2175*, 2177*, 2179*, 2181*, 3524*, 3526*, 3528*, 3529, 3531*, 3533*, 3535*, 3715, 3717, 3719, 3721, Garrett County; subsoil 904*, Washington County.

Mechanical analysis 238, published in Fourth Annual Report of the Maryland Experiment Station, page 290; also in Bulletin No. 4, Weather Bureau, page 73. Mechanical analyses 238, 897, published in Bulletin No. 21, Maryland Experiment Station, page 51.

Chesapeake, Miocene—corn, wheat, and tobacco land of southern Maryland (31 soils, 63 subsoils).

Soils 140, 178, 251, 253, 255, 598, 1120, 1122, subsoils 141*, 142*, 143, 179*, 245*°, 246*, 247*°, 248*, 252*, 254, 256, 480*, 599, 600, 601, 602, 603*, 604*, 605*, 606, 607, 608*, 609*, 610, 1121, 1123, 2162*, 2794*, 2795*, Anne Arundel County; soils 249, 261, 265, 3805, 3809, subsoils 180*, 181 ("diatomaceous earth"), 182, 250*, 262*, 266*, 3806, 3810, Calvert County; soils 183, subsoils 184*, 185 ("diatomaceous earth"), Charles County; soils 154, 161, 163, 257, 259 (Columbia, river terrace), 263, 318, 320, 2144, 2146, 2148, 2150, 2152, 2154, 2156, 2158, 2160, subsoils 152 ("diatomaceous earth"), 155*, 156, 158*, 159*, 160, 162*, 164*, 258*•, 260* (Columbia), 264 (Columbia), 280*, 286*, 319, 321, 2145*, 2147*, 2149, 2151*, 2153*, 2155*, 2157*, 2159*, 2161*, Prince George County.

Mechanical analyses 280, 286, published in Fourth Annual Report of the Maryland Experiment Station, page 277; also in Bulletin No. 4, Weather Bureau, page 73. Mechanical analyses 159, 480, 603, 605, 608, 609, published in Bulletin No. 29, Maryland Experiment Station, pages 160, 174. Mechanical analyses 141, 142, 155, 162, 164, 179, 180, 184, 245, 246, 247, 248, 250, 252, 258, 260, 262, 266, 480, published in Bulletin 21, Maryland Experiment Station, pages 34, 44–48; in Bulletin No. 4, Weather Bureau, pages 64–66, 69; also in World's Fair Book of Maryland, pages 188, 201–203. Mechanical analysis 141, published in Bulletin No. 5, Division of Soils, page 10. Mechanical analyses 155, 258, published in Principles and Practice of Agricultural Analysis, Vol. 1, No. 6, 1894, page 249.

Chemical analyses 245, 247, 258, published in Bulletin No. 21, Maryland Experiment Station, page 12.

Clay—pottery, brick, and tile (10 samples).

483 (pottery clay), 592*°, 799 (brick clay), 800 (brick clay), 2184* (pottery clay), 2235, 2236, Anne Arundel County; 303* (stoneware clay), 304* (porous tile), 305*, Baltimore County.

Mechanical analyses 303, 304, 305, 592, published in Bulletin No. 21, Maryland Experiment Station, page 55; also in Bulletin No. 4, Weather Bureau, page 71. Mechanical analysis 303, published in Bulletin No. 5, Division of Soils, page 12. Mechanical analyses 303, 304, 305, published in Rocks, Rock Weathering, and Soils, page 313.

Chemical analysis 592, published in Bulletin No. 21, Maryland Experiment Station, page 12.

Clinton—Niagara (9 soils, 4 subsoils).

Soils 239, 240 (mountain pasture), 3482*, 3484, 3487, 3702*, 3703, 3704, 3706, subsoils 3483*, 3485*, 3488*, 3705*, Allegany County.

Columbia, Lower, river terrace—corn, wheat, and tobacco land (10 soils, 14 subsoils).

Subsoil 2659*, Anne Arundel County; soil 3815, subsoil 3816, Calvert County; soils 206, 3786, subsoils 207, 208, 3787, 3788, Charles County; soils 198, 200, 202, 204, 3792, 3798, 3800, subsoils 199*, 201*○, 203*, 205*, 278*, 3793, 3799, 3801, St. Mary County.

Mechanical analysis 278, published in Fourth Annual Report of the Maryland Experiment Station, page 277. Mechanical analyses 199, 201, 203, 205, published in Bulletin No. 21, Maryland Experiment Station, page 49; also in World's Fair Book of Maryland, page 205; and in Bulletin No. 4, Weather Bureau, page 68.

Chemical analysis 201, published in Bulletin No. 21, Maryland Experiment Station, page 12.

Corn land (192 soils, 268 subsoils).

See Alluvial soil, Catskill, Chesapeake, Columbia, gabbro, gneiss, Hudson River shale, Trenton limestone, phillite, Triassic.

Eocene (6 soils, 9 subsoils, 9 samples of marl).

See Truck land, marls.

Gabbro—wheat, grass, corn (18 soils, 23 subsoils).

Soil 131, subsoils 132*, 133*, Baltimore County; soils 1024, 1027, 1029, 1031, 1033, 1241, 1243, 2968, 2970, 2972, 2974, 2976, 2978, 2980, 2982, 2984, 2986, subsoils 1025*○, 1026*, 1028*, 1030*, 1032*, 1034*, 1035*, 1242*, 1244*, 1928*, 2969, 2971*, 2973*, 2975*, 2977*, 2979*, 2981, 2983, 2985, 2987, 2991, Harford County.

Mechanical analyses 133, 1034, published in Bulletin No. 21, Maryland Experiment Station, page 50. Mechanical analysis 1034, published in Rocks, Rock Weathering, and Soils, page 308.

Chemical analysis 1025, published in Bulletin No. 21, Maryland Experiment Station, page 12.

Gneiss and granite—corn, wheat, grass (26 soils, 34 subsoils).

Soil 128, subsoils 129, 2306, Baltimore County; soils 1036, 1041, 1043, 1046, 1245, 1249, 1251, 1255, 1257, 1259, 2988, 2990, 2992, 2994, 2996, 2998, 3000, 3002, 3004, 3006, 3008, 3010, 3012, 3014, 3052, subsoils 1037*, 1038*, 1040, 1042*, 1044*, 1045*○, 1047*, 1048*, 1049*, 1246*, 1248*, 1253*, 1256*, 1258*, 2989, 2993, 2995, 2997*, 2999, 3001, 3003, 3005, 3007, 3009, 3011, 3013*, 3015, 3053, 3958*, Harford County; subsoils 3817*, 3818*, 3993, Montgomery County.

Mechanical analysis 1045, published in Bulletin No. 21, Maryland Experiment Station, page 50; in Rocks, Rock Weathering, and Soils, page 308; and in Agricultural Science, Vol. VIII, Nos. 6-9, 1894. Mechanical analyses 1038, 1045, 1047, 1246, 1258, published in Bulletin No. 29, Maryland Experiment Station, page 172.

Chemical analysis 1045, published in Bulletin No. 21, Maryland Experiment Station, page 12.

Granite.

See Gneiss, catoctin.

Grass land (147 soils, 183 subsoils).

See Catskill, gabbro, gneiss, Helderberg limestone, Trenton limestone, phillite, Triassic.

Greenhouse soil—carnations, roses (2 samples).

Soil 2249, Baltimore; soil 2234, Oakland.

Hamilton—Chemung (20 soils, 16 subsoils).

Soils 234, 235, 236, 237, 3502*, 3504*, 3506, 3508*, 3510*, 3711, subsoils 289*, 3503*, 3505*, 3507*, 3509*, 3511*, Allegany County; soils 3512, 3514*, 3517, 3519, 3712, subsoils 3513*, 3515*, 3516*, 3518*, 3520, 3713, Garrett County, "Glades"; soils 893, 894, 905, 907, 909, subsoils 895, 906, 908, 910, Washington County.

Mechanical analysis 289, published in Fourth Annual Report of the Maryland Experiment Station, page 290; also in Bulletin No. 4, Weather Bureau, page 73.

Hudson River shale (Martinsburg)—corn, wheat, fruit (13 soils, 12 subsoils).

Soils 912, 914, 916, 918, 2762, 2764, 2766, 2768, 2784, 2785*, 3882, 3884, 3886, subsoils 913*, 915*, 917*, 919*, 2763*, 2765*, 2767*, 2769*, 3881, 3883, 3885, 3887, Washington County.

Lafayette—pine barrens (7 soils, 8 subsoils).

Soils 3802, 3804, 3807, subsoils 210, 276*, 3803, 3808, Calvert County; soils 2681, 2717, subsoils 2682*, 2718*, Garrett County; soils 3794, 3796, subsoils 3795, 3797, St. Mary County.

Samples 2681, 2682, 2717, 2718, represent a fair type of corn land. The other samples are from the coarse sands and gravel forming the pine barrens of southern Maryland.

Mechanical analysis 276, published in Fourth Annual Report of the Maryland Experiment Station, page 277; in Bulletin No. 21, Maryland Experiment Station, page 36; and in Bulletin No. 4, Weather Bureau, page 73.

Limestone (54 soils, 60 subsoils).

Helderberg—grass, wheat (12 soils, 9 subsoils).

Soils 3489, 3491*, 3493*, 3494, 3707*, 3708, subsoils 3490*, 3492*, 3495, 3709*, Allegany County; soils 220*, 221*, 222, 225, 888, 890, subsoils 223*, 224*, 288*°, 889*, 891*, Washington County.

Mechanical analysis 288, published in Fourth Annual Report of the Maryland Experiment Station, page 290; in Bulletin No. 4, Weather Bureau, page 73; and in Principles and Practice of Agricultural Analysis, Vol. 1, No. 6, 1894, page 249.

Chemical analysis 288, published in Bulletin No. 21, Maryland Experiment Station, page 12.

Trenton limestone (Shenandoah)—corn, wheat, grass (42 soils, 51 subsoils).

Soils 137, 138, subsoils 139, Baltimore County; soils 1085, 1087, subsoils 1086*, 1088*, Carroll County; soils 172, 314, 316, 930, subsoils 173*, 174*, 231*, 315, 317, 931*, Frederick County; soils 312, 923, 925, 927, 928, 932, 2727*, 2729*, 2731, 2733*, 2735*, 2737*, 2739, 2741*, 2745, 2747*, 2749*, 2750*, 2752, 2754*, 2756, 2758*, 2760, 2770*, 2772*, 2774*, 2776*, 2778, 2780, 2782, 2786, 2788*, 3888, 3917, subsoils 313, 921*, 922*, 924*, 926*, 929*, 933*°, 934*, 935*, 936*, 937*, 2728*, 2730*, 2732*, 2734*, 2736*, 2738*, 2740*, 2742*, 2746*, 2748*, 2751*, 2753, 2755*, 2757*, 2759*, 2761*, 2771*, 2773*, 2775*, 2777*, 2779, 2781, 2783, 2787, 2789*, 2790*, 2791*, 2792*, 3889, 3914, 3918, Washington County.

Mechanical analyses 173, 174, 231, 933, published in Bulletin No. 21, Maryland Experiment Station, page 53. Mechanical analyses 173, 924, 926, 929, 933, 934, 935, 937, 1086, published in Bulletin No. 29, Maryland Experiment Station, page 169. Mechanical analysis 937, published in Bulletin No. 5, Division of Soils, page 10. Mechanical analysis 173, published in Report of Pennsylvania State College, 1894, Part 11, page 144. Mechanical analyses 173, 933, published in Rocks, Rock Weathering and Soils, page 308.

Chemical analysis 933, published in Bulletin No. 21, Maryland Experiment Station, page 12.

Lower coal measures (18 soils, 17 subsoils).

Bayard (6 soils, 8 subsoils).

Soils 3566, 3567, 3570, 3572, 3574, 3726, subsoils 3568, 3569, 3571, 3573*, 3575, 3727, 3728, 2729, Garrett County.

Fairfax (6 soils, 5 subsoils).

Soils 3576*, 3577, Allegany County; soils 3579, 3581, 3583, 3730, subsoils, 3578, 3580, 3582, 3584, 3731, Garrett County.

Savage (6 soils, 4 subsoils).

Soil 3725, Allegany County; soils 3557*, 3559, 3560, 3562, 3564, subsoils 3558, 3561, 3563, 3565, Garrett County.

Marls (18 samples).

Cretaceous.

211, 213, Prince George County.

Eocene.

150 (glauconite), Anne Arundel County; 193 (glauconite), Calvert County; 194 (glauconite), 196, 197, 3789, 3790, Charles County; 214, 274, Prince George County.

Miocene.

151, Anne Arundel County; 186, 188, 189, 190, 192, Calvert County; 191, St. Mary County.

Medina sandstone (3 soils, 1 subsoil).

Soil 3480, 3700*, 3701, subsoil 3481*, Allegany County.

Oriskany sandstone (4 soils, 8 subsoils).

Soils 3496*, 3498, 3500, 3710*, subsoils 226, 228, 290*, 3497*, 3499*, 3501*, Allegany County; subsoils 227, 892, Washington County.

Mechanical analysis 290, published in Fourth Annual Report of the Maryland Experiment Station, page 290; also in Bulletin No. 4, Weather Bureau, page 73.

Phillite—corn, wheat, grass (24 soils, 31 subsoils).

Soils 950, 1089, 1091, subsoils 951*, 952*, 953*, 954*, 955*, 956*, 957*, 958*, 1090*, 1092*, 1093*, Carroll County; soils 3016, 3018, 3020, 3022, 3024, 3026, 3028, 3038, 3040, 3042, 3044, 3046, 3048, 3050, 3059, 3061, subsoils 2725* (residuary slate), 3017*, 3019*, 3021*, 3023, 3025*, 3027, 3029*, 3039*, 3041, 3043*, 3045, 3047*, 3049, 3051, 3060, 3062, Harford County; soils 215, 217, 219*, 2303, 2305, subsoils 216*, 218*, 2304, Montgomery County.

Potomac (7 soils, 6 subsoils).

Soils 2648, 2654, 2656, 2660, 2662, subsoils 2649*, 2655*, 2657*, 2661*, 2663*, Anne Arundel County; soils 2705, 2707, subsoil 2706*, Prince George County.

The Potomac formation in Maryland is characterized by a great variation in texture, ranging from coarse sands to variegated clays, almost impervious to water. The samples above are of very infertile agricultural lands. For other samples from this formation *see* the special collection of pottery clays.

Pottsville (5 soils, 3 subsoils).

Soil 3724*, Allegany County; soils 3550, 3552, 3554, 3556, subsoils 3551, 3553, 3555, Garrett County.

Quartzite—sandy chestnut ridge (1 soil, 1 subsoil).

Soil 135, subsoil 136, Baltimore County.

Salina sandstone (1 soil).

Soil 233, Washington County.

Serpentine—bare hills (5 soils, 5 subsoils).

Soil 3873, subsoil 134, Baltimore County; soils 3030, 3032, 3034, 3036, subsoils 3031*, 3033*, 3035, 3037*, Harford County.

Subcarboniferous (9 soils, 6 subsoils).

Greenbrier (3 soils, 3 subsoils).

Soils 3541, 3542, 3544*, subsoils 3543*, 3545*, 3546*, Garrett County.

Mauch Chunk (3 soils, 1 subsoil).

Soils 3549, 3723*, Allegany County; soil 3547, subsoil 3548*, Garrett County.

Pocono sandstone (3 soils, 2 subsoils).

Soil 3536, subsoil 3537*, Allegany County; soils 3538*, 3539*, subsoil 3540*, Garrett County.

Tobacco land—manufacturing type (41 soils, 77 subsoils).

See Chesapeake, Columbia.

Triassic red sandstone—corn, wheat, grass (5 soils, 10 subsoils).

Subsoil 3957*, Carroll County; soils 175, 947, 1079, 1081, 1083, subsoils 176*, 177*, 282*, 948*, 949*°, 1080*, 1082*, 1084*, 3063, Frederick County.

Mechanical analysis 282, published in Fourth Annual Report of the Maryland Experiment Station, page 290; in Bulletin No. 4, Weather Bureau, page 73; and in Rocks, Rock Weathering, and Soils, page 308; and in Principles and

Triassic red sandstone—corn, wheat, grass (5 soils, 10 subsoils)—Continued.

Practice of Agricultural Analyses, Vol. 1, No. 6, 1894, page 249. Mechanical analyses 282, 919, published in Bulletin No. 21, Maryland Experiment Station, page 51.

Chemical analysis 949 published in Bulletin No. 21, Maryland Experiment Station, page 12.

Truck land (81 soils, 94 subsoils).

Eastern Shore—mainly Columbia (30 soils, 35 subsoils).

Soils 1218, 1222, 1239, subsoils 1219*, 1223*, 1240*, 1989*, Caroline County; soils 1183, 1185, 1224, 1227, 1229, 1231, 1233, 1235, 1237, 1296, 1298, 2549, subsoils 1184, 1186*, 1225*, 1228*, 1230*, 1232*, 1234*, 1236*, 1238*, 1297*, 1299*, 1301*, 2550, Dorchester County; soils 7, 281, 1187, 1189, 1191, 1193, 1195, 1197, 1202, 1206, 1208, 1210, 1212, 1214, 1216, subsoils 17*, 283, 1188*, 1190*, 1192*, 1194, 1196, 1198*, 1203, 1204, 1205, 1207*, 1209*, 1211, 1213*, 1215*, 1217*, 2806*, Wicomico County.

Mechanical analyses of the above samples, as indicated by the *, with the exception of 17, 1301, 1989, 2806, were published in Bulletin No. 29, Maryland Experiment Station, page 165. Mechanical analysis 1209, published in Bulletin No. 129, North Carolina Experiment Station, 1896, page 174.

Mechanical analysis 1207, published in Bulletin No. 5, Division of Soils, page 16. Mechanical analyses 1186, 1188, 1190, 1192, 1198, 1207, 1209, 1213, 1215, 1217, 1219, 1223, 1225, 1228, 1230, 1232, 1234, 1236, 1238, 1240, 1297, 1299, published in Yearbook, Department of Agriculture, 1894, pages 140, 141.

Southern Maryland—mainly Columbia (51 soils, 59 subsoils).

Soils 4, 144, 147, 267, 269, 466, 468, 470, 475, 477, 479, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 589½*, 593 (Eocene), 595, 596, 804, 806, 808, 810, 812, 816, 818, 2015, 2119, 2187, 2650, 2652, 2658, subsoils 145*, 146, 148 (Eocene), 268*, 270*, 284*, 467*°, 469*, 471*, 472*°, 473*, 474, 476*, 478*, 481, 561*, 563*, 565*, 567*, 569*, 571*, 573*, 575*, 577*, 579*, 581*, 583*, 585*, 587*, 589*, 590*, 591*, 594 (Eocene), 597 (Eocene), 805, 807, 809, 811, 813, 815*, 817, 2118*, 2120*, 2188*, 2189*, 2190*, 2651*, 2653*, Anne Arundel County; soils 3811, 3813, subsoils 209*• (Lafayette), 3812, 3814, Calvert County; soils 165 (Eocene), 167 (Eocene), 170 (Eocene), 271 (Eocene), 273, 2693 (Eocene), subsoils 157 (Chesapeake), 166 (Eocene), 168 (Eocene), 169 (Eocene), 171 (Eocene), 272, 444 (Eocene), 2694 (Eocene), Prince George County.

Samples 804–817 and some of the other samples under this head possibly belong to the sandy phase of the Potomac (Lower Cretaceous).

Mechanical analysis 284, published in Fourth Annual Report of the Maryland Experiment Station, page 277; also in Bulletin No. 4, Weather Bureau, page 73. Mechanical analyses 467, 469, 471, 472, 473, 478, 561, 563, 565, 567, 569, 571, 575, 577, 583, 585, 587, 589, 590, 591, published in Bulletin No. 21, Maryland Experiment Station, pages 40–42; also in Bulletin No. 4, Weather Bureau, pages 56–61, 69. Mechanical analyses 145, 268, 270, 467, 476, 573, 579, 581, published in Bulletin No. 4, Weather Bureau, pages 56–61. Mechanical analyses 467, 469, 471, 472, 473, 478, 590, 591, published in World's Fair Book of Maryland, pages 188–208. Mechanical analyses 145, 209, 268, 270, 467, 469, 471, 472, 473, 476, 561, 563, 565, 567, 569, 571, 573, 575, 577, 579, 581, 583, 585, 587, 589, 589½, 590, 591, 815, published in Yearbook, Department of Agriculture, 1894, pages 139–140. Mechanical analysis 472 published in Bulletin No. 5, Division of Soils, page 10. Mechanical analysis 209 published in Bulletin No. 21, Maryland Experiment Station, page 36. Mechanical analyses 467, 472, 478, published in Bulletin No. 29, Maryland Experiment Station, page 160. Mechanical analyses 268, 472, published in Principles and Practice of Agricultural Analysis, Vol. 1, No. 6, 1894, page 249. Mechanical analysis 815, published in Bulletin No. 129, North Carolina Experiment Station, 1896, page 174.

Truck land (81 soils, 94 subsoils)—Continued.

Chemical analysis 209, published in Bulletin No. 21, Maryland Experiment Station, page 12. Chemical analyses 467, 472, published in Bulletin No. 21, Maryland Experiment Station, page 12.

Unclassified (6 soils, 11 subsoils, 9 miscellaneous samples).

Soil 3592, subsoil 3593, Alleghany County; soil 3862, Anne Arundel County; subsoil 3695, Calvert County; soils 2169*, 3057, subsoils 3054*, 3055, 3056, 3058, Harford County; soil 2800*, subsoils 2801*, 2802*, Kent County; soil 2796*, subsoils 2797*, 2798*, 2799*, Worcester County.

Miscellaneous samples.

149 (black marsh land), 482, 801 (glass sand, No. 1 grade, from Severn River), 802 (glass sand, No. 2 grade, from Severn River), 803, 3863, Anne Arundel County; 1613* (molding sand), Baltimore County; 212* (quicksand), 275, Calvert County.

Upper coal measures (4 soils, 3 subsoils).

Soils 3585*, 3587, 3589, 3590, subsoils 3586*, 3588*, 3591*, Allegany County.

Wheat land (253 soils, 327 subsoils).

Eastern Shore (49 soils, 53 subsoils).

Soils 1124, 1126, 1128, 1130, 1132, 1134, 1136, 1300, 2543, 2545, 2547, subsoils 1125*, 1127*, 1129*, 1131, 1133, 1135*, 1137*, 2544, 2546, 2548, 2564, Dorchester County; soils 1152, 1154, 1156, 1220, 1984, 1986, 1988, subsoils 1153*, 1155, 1157*, 1221*, 1985*, 1987*, Caroline County; soils 766, 768, 770, 772, 774, 776 ("white oak land"), subsoils 767*, 769*, 771*, 773*, 775*, 777* ("white oak land"), Kent County; soils 1158, 1160, 1162, 1164, 1166, 1168, 1170, 1172, 1174, 1178, 1180, subsoils 1159*, 1161*, 1163, 1165*, 1167*, 1169*, 1171*, 1175*, 1181*, 1182*, 1226*, Queen Anne County; soils 1138, 1140, 1142, 1144, 1146, 1148, 1150, 2558, 2560 ("white oak land"), subsoils 1139*, 1141*, 1143*, 1145*, 1147*, 1149*, 1151*, 2559, 2561 ("white oak land"), 2562 ("white oak land"), 2563, Somerset County; soils 1176, 2551, 2553, 2555, ("white oak land"), subsoils 1177*, 1179*, 2552, 2554, 2556 ("white oak land"), 2557 ("white oak land"), Talbot County; soil 1199, subsoils 1200, 1201, Wicomico County.

Mechanical analyses 1125, 1127, 1135, 1137, 1141, 1143, 1151, 1159, 1161, 1165, 1167, 1169, 1175, 1177, 1179, 1181, published in Bulletin No. 29, Maryland Experiment Station, page 167.

For other samples of wheat lands *see* Alluvial soil, Catskill, Chesapeake, Columbia, gabbro, gneiss, Hudson River shale, Helderberg limestone, Trenton limestone, phillite, Triassic red sandstone.

MASSACHUSETTS.

(65 samples.)

The samples from Massachusetts were obtained from two sources. Part of the samples were collected by the Massachusetts Experiment Station in getting their samples for the Chicago Exposition, and the other samples were collected by agents of the United States Department of Agriculture.

[Mechanical analyses have been made of the samples marked (*).]

Alluvial soil—cranberry bogs and other marshes (5 soils, 5 subsoils).

Soils 1054, 1056, subsoils 1055, 1057, Marshfield; soil 1263, subsoil 1264, Sudbury; soil 1009, subsoil 1010, Yarmouth. Collected by the experiment station.

Soil 195, subsoil 500, Mount Auburn. Collected by agent of the United States Department of Agriculture.

Diabase (1 subsoil).
Subsoil 347. George P. Merrill, collector.
Greenhouse soil (10 samples).
Carnations, roses.
Soil 2241, Framingham.
Lettuce, cucumbers.
Soils 2256*, 2258*, Belmont; soils 15* 63*, 1602, 1603, 2242*, Boston; soils 2277, 2278, Winchester; mechanical analysis of a soil similar to No. 15 published in Agricultural Science, Vol. VIII, Nos. 6-9, 1894.
Tobacco land (cigar type), (12 soils, 10 subsoils).
Soils 867*, 881, 920*, 1013*, 1106*, 1112, 1114, 1247 (heavy, dark type, not used at present for tobacco), 1271, 1934, subsoils 875*, 901*, 999*, 1039*, 1113, 1173*, 1250* (heavy, dark type, not used at present for tobacco), 1272, 1273, Hatfield; soil 1935, South Deerfield; soil 1110, subsoil 1111*, Whately. Collected by agents of the United States Department of Agriculture.
Mechanical analyses 875, 901, 999, 1039, 1173, 1250, published in Yearbook, Department of Agriculture, 1894, page 148. Mechanical analysis 1173, published in Report of Pennsylvania State College, 1894, Part II, page 144; also in Bulletin No. 5, Division of Soils, page 18.
Mechanical analyses 875, 901, 1039, 1111, 1173, published in Bulletin No. 11, Division of Soils, page 40.
Truck land (1 soil, 3 subsoils).
Soil 501, subsoils 95*, 187*, 508*, Mount Auburn. Collected by agents of the United States Department of Agriculture.
Mechanical analyses 95, 187 (greenhouse soil), 508, published in Yearbook, Department of Agriculture, 1894, page 143. Mechanical analysis 508, published in Bulletin No. 5, Division of Soils, page 16. Mechanical analysis 187, published in Bulletin No. 129, North Carolina Experiment Station, 1896, page 174.
Unclassified (9 soils, 9 subsoils).
Soils 820, 822, subsoils 821, 823, Agawam; soil 1265, subsoil 1266, Amherst; soil 970, subsoil 971, Dedham; soil 1269, subsoil 1270, Deerfield; soil 1261, subsoil 1262, Hadley; soil 1052, subsoil 1053, Hubbardston; soil 1108, subsoil 1109, Pittsfield; soil 1267, subsoil 1268, Wendall. Collected by the Experiment Station.

MEXICO.

(6 samples.)

[Mechanical analyses have been made of samples marked (*).]

Tobacco (cigar type)—sugar, coffee (6 soils).
Soils 3634*, 3635*, 3636*, 3637*, 3638*, 3639*, Ozumacin, Oaxaca.

MICHIGAN.

(5 samples.)

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil—celery soil (1 sample).
Soil 4000, Kalamazoo.
Greenhouse soil (4 samples).
Carnations, roses.
Soil 2247*, Grand Haven.
Lettuce, cucumbers.
Soils 2233*, 2243*, 2257*, Grand Rapids.

MINNESOTA.

(26 samples.)

The samples from Minnesota were collected by the State Geological Survey.

[Mechanical analysis has been made of sample marked (*).]

Alkali land (1 soil, 1 subsoil).
  Soil 2301, subsoil 2302, Marshall County.
Alluvial soil, Tamerse River (prairie)—wheat (8 soils, 6 subsoils).
  Soil 2296, subsoil 2297, Marshall County.
  For additional samples *see* Lacustrine.
Drift—wheat (1 soil, 1 subsoil).
  Soil 2287, subsoil 2288, Polk County.
Greenhouse soil—carnations, roses (1 sample).
  Soil 2240*, St. Paul.
Lacustrine (old Lake Agassiz, present Red River Valley (prairie)—wheat (7 soils, 5 subsoils).
  Soil 1495, subsoil 1496, Clay County; soils 2289, 2291, 2293, 2294, 2298, 2299 (gumbo), subsoils 2290, 2292, 2295, 2300 (gumbo), Marshall County.
Prairie (9 soils, 7 subsoils).
  See Alluvial soil, lacustrine, wheat land.
Wheat land (12 soils, 11 subsoils).
  Soils 1483 (prairie), 1486, subsoils 1484 (prairie), 1485, 1487, Carver County; soil 1493, subsoil 1494, Wright County. For other samples of wheat land *see* Alluvial soil of Tamerse River, drift, lacustrine.

MISSISSIPPI.

(28 samples.)

These samples were collected by the Mississippi Experiment Station.

Alkali land (1 soil, 1 subsoil).
  Soil 3919, subsoil 3920, Holmes County. J. W. McLellar, collector.
Cotton land (7 soils, 7 subsoils).
  See Flatwoods, live-oak land, long-leaf pine region, prairie, short-leaf pine upland.
Corn land (7 soils, 7 subsoils).
  See Flatwoods, live-oak land, long-leaf pine region, prairie, short-leaf pine upland.
Flatwoods region—cotton, corn (1 soil, 1 subsoil).
  Soil 1382, subsoil 1383, Oktibbeha County.
Live-oak land—cotton, corn (1 soil, 1 subsoil).
  Soil 1481, subsoil 1482, Jackson County.
Long-leaf pine region—cotton, corn (1 soil, 1 subsoil).
  Soil 1475, subsoil 1476, Jackson County.
Pontotoc ridge (1 soil, 1 subsoil).
  Soil 1390, subsoil 1391, Pontotoc County.
Prairie—cotton, corn (3 soils, 3 subsoils).
  Soil 1477, subsoil 1478, Noxubee County; soils 1384, 1386, subsoils 1385, 1387, Oktibbeha County.
Short-leaf pine upland—cotton, corn (1 soil, 1 subsoil).
  Soil 1380, subsoil 1381, Oktibbeha County.
Unclassified (5 soils, 5 subsoils).
  Soil 782, subsoil 783, Harrison County; soils 701, 780, subsoils 702, 781, Holmes County; soil 1479, subsoil 1480 (light bottom land), Marshall County; soil 1388, subsoil 1389, Newton County.

MISSOURI.

(1 sample.)

[Mechanical analysis has been made of sample marked (*).]

Clay, pottery (1 sample).

1969* (glass pots and fire brick), St. Louis. Contributed by Prof. Edwin Orton.

MONTANA.

(71 samples.)

The samples from Montana were collected by agents of the Department in the investigations of the alkali soils of the Yellowstone Valley, published in Bulletin No. 14 of this Division. The samples were all collected within a radius of 15 miles of Billings. Geologically they belong to the Montana epoch of the Cretaceous; the soils are derived from the disintegration of the Pierre shales, forming the bluffs on the south side of the valley and extending to a depth of more than 900 feet under the valley, and from the Fox Hill sandstone bluffs on the north side of the valley.

[Mechanical analyses have been made of samples marked (*).]

Fox Hill sandstone (1 soil, 1 subsoil).

Soil 3756*, subsoil 3755, Yellowstone County.

Mechanical analysis, 3756, published in Bulletin No. 14, Division of Soils, page 19.

Pierre shales (2 subsoils).

Subsoil 3754, 3757, Yellowstone County.

Prairie (15 soils, 52 subsoils).

Alkali land (6 soils, 14 subsoils).

Soils 3305, 3357, 3360, 3361, 3758 (gumbo), 3773 (gumbo), subsoils 3306*, 3358, 3359, 3362, 3363, 3364, 3774 (gumbo), 3775 (gumbo), 3776 (gumbo), 3777 (gumbo), 3782, 3783, 3784, 3785, Yellowstone County.

Mechanical analysis 3306, published in Bulletin No. 14, Division of Soils, page 19.

Gumbo (3 soils, 7 subsoils).

Soil 3769*, subsoils 3770, 3771, 3772, Yellowstone County.

Mechanical analysis 3769, published in Bulletin No. 14, Division of Soils, page 19.

For additional samples of gumbo, *see* under Alkali lands.

Miscellaneous (8 soils, 35 subsoils).

Soils 3307*, 3314, 3321, 3365, 3370, 3759, 3778, 3781, subsoils 3308*, 3309*, 3310, 3311, 3312, 3313, 3315, 3316, 3317, 3318, 3319, 3320, 3322*, 3323, 3366, 3367, 3368, 3369, 3371, 3372, 3373, 3374, 3375, 3376, 3760, 3761, 3762, 3763, 3764, 3765, 3766, 3767, 3768, 3779, 3780, Yellowstone County.

Mechanical analysis 3322, published in Yearbook, Department of Agriculture, 1897, page 440. Mechanical analyses 3307, 3308, 3309, 3322, published in Bulletin No. 14, Division of Soils, page 19.

NEBRASKA.

(182 samples.)

[Mechanical analysis has been made of sample marked (*).]

Fuller's earth (1 sample).

3239*. Contributed by Hon. Wm. V. Allen.

Prairie (92 soils, 85 subsoils).

Carboniferous (2 soils, 2 subsoils).

Soil 2072, subsoil 2073*, Cass County; soil 2070*, subsoil 2071*, Otoe County. E. H. Barbour, collector.

Cretaceous (11 soils, 11 subsoils).

Colorado group (7 soils, 7 subsoils).

Soil 2104, subsoil 2105*, Boone County; soil 2112, subsoil 2113*, Butler County; soil 1491, subsoil 1492*, Cedar County; soil 2092, subsoil 2093*, Hamilton County; soil 2108, subsoil 2109*, Merrick County; soil 2096, subsoil 2097*, Nance County. E. H. Barbour, collector.

Soil 419, subsoil 420, Deuel County. Collected by agents of the United States Department of Agriculture.

Dakota group (4 soils, 4 subsoils).

Soil 1468, subsoil 1469*, Burt County; soil 2086, subsoil 2087*, Saline County; soil 2074, subsoil 2075*, Saunders County; soil 1470, subsoil 1471*, Thurston County. E. H. Barbour, collector.

Loess (9 soils, 17 subsoils).

Soil 417, subsoil 418*, Adams County; soils 1670*, 1864, 1867, subsoils 1671*, 1865*, 1866*, 1868*, 1869*, Fillmore County; soils 388, 390, subsoils 389*, 391*, Hitchcock County; soil 423, subsoil 424, Lincoln County; soil 3739, subsoils 3740, 3741, 3742, Phelps County. Collected by agents of the United States Department of Agriculture.

Soil 1712*, subsoils 1713*, 1714*, 1715*, 1716*, 1717*, Nemaha County. Collected under the direction of R. W. Furnas.

Mechanical analyses 1671, 1715, published in Bulletin No. 5, Division of Soils, page 12. Mechanical analysis 1717, published in Monthly Weather Review, January, 1895, page 17; also published in Rocks, Rock Weathering, and Soils, page 331.

Magnesia (1 soil, 1 subsoil).

Soil 1805*, subsoil 1806*, Perkins County. Robert Hay, collector.

Plains marl (4 soils, 11 subsoils).

Soils 1800*, 1808*, subsoils 1797*, 1801*, 1809*, 2809*, Deuel County; subsoils 1794*, 1795*, Dundy County; soil 1798*, subsoils 1803*, 1804*, Keith County; subsoil 1799. Robert Hay, collector.

Subsoil 414, Deuel County; soil 411, subsoil 412, Keith County. Collected by agents of the United States Department of Agriculture.

Mechanical analysis 1803, published in Bulletin No. 5, Division of Soils, page 14.

Tertiary (22 soils, 22 subsoils).

Soil 1439, subsoil 1440*, Adams County; soil 2084, subsoil 2085*, Blaine County; soil 2078, subsoil 2079*, Box Butte County; soil 2116, subsoil 2117*, Buffalo County; soil 685, subsoil 686*, Cheyenne County; soil 2088, subsoil 2089*, Custer County; soil 681, subsoil 682*, Deuel County; soil 1466, subsoil 1467*, Fillmore County; soil 2082, subsoil 2083*, Garfield County; soil 1489, subsoil 1490*, Gasper County; soil 2090, subsoil 2091*, Grant County; soil 2106, subsoil 2107*, Greeley County; soil 2110, subsoil 2111*, Hall County; soil 2076, subsoil 2077*, Dawes County; soil 2100, subsoil 2101*, Hooker County; soil 2080, subsoil 2081*, Howard County; soil 2102, subsoil 2103*, Loup County; soil 1437, subsoil 1438*, Perkins County; soil 1435, subsoil 1436*, Phelps County; soil 2094, subsoil 2095*, Sherman County; soil 2098, subsoil 2099*, Thomas County; soil 2114, subsoil, 2115*, Valley County. E. H. Barbour, collector.

Unclassified (43 soils, 21 subsoils).

Subsoil 1802, Deuel County; subsoil 1796, Dundy County; soil 1807, Perkins County. Robert Hay, collector.

Prairie (92 soils, 85 subsoils)—Continued.

Unclassified (43 soils, 21 subsoils)—Continued.

Soil 1813*, Antelope County; soil 1815, subsoils 1822, 1834, Buffalo County; soil 1811, subsoil 1812*, Cass County; soil 1823, Dawes County; soil 1855, Deuel County; soil 1827, Dixon County; soil 1826, Douglas County; soils 1810,* 1836, Furnas County; soil 1820*, Gage County; soil 1821, Grant County; soil 1811*, Harlan County; soil 1837, subsoil 1838*, Harlan County; soils 1825, 3683*, subsoils 3681*, 3685*, 3686*, Holt County; soil 1828*, Jefferson County; soil 1835, Johnson County; soil 1839, subsoil 1840*, Kearney County; soil 3242*, subsoil 3243*, Lancaster County; soil 1824, Logan County; soil 1813, subsoil 1814*, Madison County; soil 1817, subsoil 1818, Merrick County; soil 1832*, Phelps County; soil 1819*, Polk County; soil 1831, Saline County; soil 1830*, Scotts Bluff County; soil 1829*, Sioux County; soil 1816, Washington County; soil 1812, Wayne County. Collected under the direction of R. W. Furnas.

Soil 1617*, Cheyenne County; soils 413, 415, subsoil 416*, Deuel County; soils 1915*, 1916*, Douglas County; soils 392, 394, subsoils 393*, 395*, Dundy County; soils 421, 2163, subsoils 422*, 2164, Lincoln County; soils 348, 350, 352, subsoils 349*, 351*, 353*, Otoe County; soil 1851, York County. Collected by agents of the United States Department of Agriculture.

Volcanic ash (1 subsoil).

Subsoil 3979 (mixed sample), Chase, Clay, and Dawson counties. E. H. Barbour, collector.

Wind-blown dust, or "black snow" (3 samples), 687, 688, 689.

NEVADA.

(14 samples.)

[Mechanical analyses have been made of samples marked (*).]

Alkali land (2 soils, 5 subsoils).

Soils 3418*, 3421, subsoils 3419*, 3420*, 3422*, 3423, 3963*, Elko County. Collected by agents of the United States Department of Agriculture.

Mechanical analysis 3419, published in Yearbook, Department of Agriculture, 1897, page 440.

Unclassified (5 soils, 2 subsoils).

Subsoil 1293, Douglas County; soils 1290, 1292, Elko County; soil 1433, subsoil 1434, Lander County; soil 1119, Humboldt County; soil 1291 (salt grass), Washoe County. Collected by the Nevada Experiment Station.

NEW HAMPSHIRE.

The collection contains no samples from New Hampshire.

NEW JERSEY.

(107 samples.)

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil (3 soils, 1 subsoil).

Cedar swamp (1 soil, 1 subsoil).

Soil 2671, subsoil 2672, Cumberland County. Collected by agents of the United States Department of Agriculture.

Cranberry bog (2 soils).

Soils 1787*, 1788*, Middlesex County. Collected by New Jersey Experiment Station.

Clay, pottery (1 sample).

1967* (china clay). Contributed by Prof. Edwin Orton.

Cretaceous (8 soils, 8 subsoils).

Soil 1763, subsoil 1764, Burlington County; soil 1745, subsoil 1746, Mercer County; soils 1651, 1655, 1759, subsoils 1652, 1656, 1760, Monmouth County; soils 1633, 1637, subsoils 1634, 1638, Ocean County; soil, 1772 subsoil 1773. G. A. Knapp, collector.

Greenhouse soil—carnations, roses (6 samples).

Soil 2248, Belleville; soils 2814*, 2815*, 2816*, Brunswick; soil 2237*, Jersey City; soil 2276, Summit.

Miocene (2 soils, 2 subsoils).

Soil 1749, subsoil 1750, Burlington; soil 1657, subsoil 1658, Monmouth County. G. A. Knapp, collector.

Truck land, Columbia (36 soils, 40 subsoils).

Soils 1729, 1741, subsoils 1730, 1742, Burlington County; soils 1723, 1727, 1735, 1737, 1739, 1747, 1753, 1769, subsoils 1724, 1728, 1736, 1738, 1740, 1748, 1752, 1754, 1770, 1771, Mercer County; soils 1631, 1645, 1725, subsoils 1632, 1646, 1726, Middlesex County; soils 1627, 1629, 1635, 1641, 1643, 1661, 1755, 1757, 1767, subsoils 1628, 1630, 1636, 1642, 1644, 1654, 1662, 1756, 1758, 1768, Monmouth County; soils 1731, 1733, 1761, 1765, subsoils 1732, 1734, 1762, 1766, Ocean County; soil 1743, subsoil 1744. G. A. Knapp, collector.

Soils 1647*, 1649*, subsoils 1648*, 1650*, Monmouth County. Collected by New Jersey Experiment Station.

Soils 2664*, 2666, 2668, 2673*, 2675, 2677, 2679*, subsoils 2665*, 2667, 2669*, 2670*, 2674*, 2676, 2678, 2680*, Cumberland County. Collected by agents of the United States Department of Agriculture.

NEW MEXICO.

(6 samples.)

The samples from New Mexico were collected by Prof. A. E. Blount. The exact localities of the samples were not given.

[Mechanical analyses have been made of samples marked (*).]

Adobe (1 soil).

Soil 612*.

Dead land (2 soils).

Soils 615* (coarse), 684 (fine).

Gumbo (1 soil).

Soil 611*.

Mesa soil (1 soil, 1 subsoil).

Soil 613, subsoil 614*.

NEW YORK.

(105 samples.)

[Mechanical analyses have been made of samples marked (*).]

Clay, pottery (1 sample).

1971* (Albany slip clay), Albany. Contributed by Prof. Edwin Orton.

Greenhouse soil (21 samples).

Carnations, roses.

Soil 2228*, Alplaus; soil 2226*, Floral Park; soils 2267*, 2268*, 2269*, 2270*, 2271*, 2272*, 2273*, Ithaca; soil 2227*, Queens; soil 2239*, Tarrytown.

Lettuce, cucumbers.

Soil 2266*, Ithaca.

Violets.

Soils 2253*, 2254*, 2255*, 2259 2260*, 2264*, 2265* (propagating sand), 2274, 2275*, Poughkeepsie.

Shales—rye land (2 soils, 2 subsoils).

Soils 436, 1721*, subsoils 437, 438, Rensselaer County. T. Nelson Dale, collector.

Tobacco land (cigar type) (11 soils, 9 subsoils).

Soil 1354, subsoil 1355*, Cayuga County; soils 1282, 1288, 1351, 1352, subsoils 1283*, 1289*, 1353*, Onondaga County; soils 1278, 1280, 1356, 1936, subsoils 1279*, 1281*, 1357*, Oswego County; soils 1284, 1286*, subsoils 1285*, 1287*, Wayne County. Collected by agents of the United States Department of Agriculture.

Mechanical analyses 1279, 1281, 1283, 1285, 1286, 1287, 1289, 1353, 1355, 1357, published in Bulletin No. 11, Division of Soils, page 40.

Truck land, Columbia (9 soils, 12 subsoils).

Soils 538, 556, 559, 617, subsoils 539*, 558*, 616*, 618, Queens County; soils 22, 29, 36*, 55*, subsoils 18*, 20*, 21*, 23*, 31*, 43*, 56*, Kings County; soil 528, subsoil 532*, Suffolk County. Collected by agents of the United States Department of Agriculture.

Mechanical analyses 18, 20, 23, 31, 43, 55, 56, 532, 539, 558, 616, published in Yearbook, Department of Agriculture, 1894, page 142. Mechanical analysis 539, published in Bulletin No. 5, Division of Soils, page 16; also published in Bulletin 129, North Carolina Experiment Station, 1896, page 174.

Unclassified (19 soils, 19 subsoils).

Soil 1392, subsoil 1393, Cayuga County; soil 1400 (muck), subsoil 1401 (muck), Chemung County; soil 1416, subsoil 1417, Cortland County; soil 1410, subsoil 1411, Delaware County; soil 1404, subsoil 1405, Fulton County; soil 1424, subsoil 1425, Orange County; soil 1428, subsoil 1429, Orleans County; soils 1398, 1412, subsoils 1399, 1413, Oswego County; soil 1414, subsoil 1415, Putnam County; soil 1420, subsoil 1421, Queens County; soil 1426, subsoil 1427, Schenectady County; soil 1408, subsoil 1409, Schoharie County; soil 1402, subsoil 1403, Schuyler County; soil 1396, subsoil 1397, Seneca County; soil 1422, subsoil 1423, Steuben County; soil 1418, subsoil 1419, Tompkins County; soil 1394; subsoil 1395, Washington County; soil 1406, subsoil 1407, Wayne County. Collected under the direction of Dr. Peter Collier of the New York (Geneva) Experiment Station.

NORTH CAROLINA.

(181 samples.)

The samples from North Carolina, except where noted, were collected by agents of the United States Department of Agriculture.

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil—rice lands (4 soils, 3 subsoils).

Soil 998, Brunswick County; soil 1000, subsoil 1001, Craven County; soil 996, subsoil 997, Lenoir County; soil 994, subsoil 995, Onslow County.

Gneiss—cotton, corn, wheat (1 soil, 4 subsoils).

Subsoil 40, Alexander County; subsoil 1899, Caswell County; soil 52, subsoils 53, 54, Mecklenburg County.

Greenhouse soil—carnations, roses (1 sample).

Soil 2238*, Asheville.

Pocoson region (4 soils, 4 subsoils).

Soils 1525, 1527, 1529, 1531, subsoils 1526, 1528, 1530*, 1532, Perquimans County.

Tobacco land (cigarette) (20 soils, 19 subsoils).

Soils 748*, 749*, subsoils 761*, 762*, Buncombe County; soil 744*, subsoil 757*, Davie County; soil 742*, subsoil 755*, Durham County; soil 746*, subsoils 759*, 3960*, Granville County; soil 747*, subsoil 760*, Haywood County; soil 750*, subsoil 763*, Madison County; soil 741*, subsoil 754*, Nash County; soil 745*, subsoil 758*, Pitt County. Collected under the direction of Dr. H. B. Battle, director of the North Carolina Experiment Station.

Tobacco land (cigarette) (20 soils, 19 subsoils)—Continued.

Soils 1910, 1912, subsoil 1913*, Davie County; soil 1907, subsoil 1908*, Durham County; soils 19, 1614, subsoil 117*, Granville County; soils 1902 (heavy land, unfit for bright tobacco, suitable for corn), 1904, subsoils 1905 (pipe clay which underlies some of the lands, making them unfit for tobacco), 1906, 1909, Nash County; soil 1911, Stokes County; soils 2949, 3982, 3984, subsoils 2950, 3983, 3985, Wilson County.

Mechanical analysis 117 published in Bulletin No. 3, Division of Soils, page 10. Mechanical analyses 758, 760, 761 published in Bulletin No. 21, Maryland Experiment Station, page 43. Mechanical analysis 759 published in Bulletin No. 5, Division of Soils, page 21. Mechanical analyses 754, 757, 758, 759, 760, 761, 762, 763 published in Report of the State Board of Agriculture, Virginia, 1895, page 151. Mechanical analyses 117, 741, 742, 744, 745, 746, 747, 748, 749, 750, 754, 755, 757, 758, 760, 761, 762, 763 published in Bulletin No. 11, Division of Soils, page 43.

Truck land (16 soils, 25 subsoils).

Soils 1569, 1580, subsoils 1570*, 1571*, 1581, Camden County; soils 1521, 1523, subsoils 1522*, 1524*, Chowan County; soils 1509, 1511, 1513, 1516, subsoils 1510*, 1512, 1514*, 1515*, 1517*, Craven County; soil 1533, subsoils 1534*, 1542*, Perquimans County; soils 1518, 1547, 1549, 1561, 1563, 1565, subsoils 1519*, 1520*, 1548, 1550, 1562, 1564, 1566*, Pasquotank County.

Soil 2316*, subsoils 2317*, 2318*, 2319*, 2320*, 2321*, 2322*, Moore County. Collected by Dr. H. B. Battle, director of the North Carolina Experiment Station, from the area selected by the State Horticultural Society for the experiments with fruit and truck.

Mechanical analyses 1510, 1514, 1517, 1519, 1522, 1524, 1534, 1542, 1566, 1570, published in Yearbook, Department of Agriculture, 1894, page 136. Mechanical analysis, 1510, published in Bulletin No. 5, Division of Soils, page 16. Mechanical analyses, 1510, 1514, published in Report of Virginia State Board of Agriculture, page 147. Mechanical analyses, 1510, 2316, 2317, 2318, 2319, 2320, 2321, 2322, published in Bulletin 129, North Carolina Experiment Station, 1896, page 174.

Unclassified (40 soils, 41 subsoils).

Soils 1572, 1574, 1576, 1578, subsoils 1573, 1575, 1577, Camden County; soils 1582, 1584, 1586, subsoils 1579*, 1583, 1585, 1587, Currituck County; soils 1551, 1553, 1555, 1557, 1559, subsoils 1552, 1554, 1556, 1558*, 1560, Durant Neck; soils 1545, 1567, subsoils 1546, 1568, Pasquotank County; soils 1535, 1537, 1539, 1541, 1543, subsoils 1536, 1538, 1540*, 1544, Perquimans County. These samples are for the most part heavy clay, or rather silt soils forming a vast tract of level country. As a rule the soils are wet and close and need underdrainage. They are much too heavy for early truck, but where the drainage is sufficient they form excellent corn lands and fair wheat lands. They underlie most of the truck lands in eastern North Carolina, being covered usually with 18 or 20 inches or more of sand.

Soils 3943, 3945, 3947, 3949, 3951, subsoils 3944, 3946, 3948*, 3950*, 3952*, 3953*, Beaufort County; soils 3841, 3842, Chowan County; soil 1900, subsoil 1901, Davie County; soils 1981, 2191, 2193, 2203, 2205, subsoils 1996, 2192, 2194, 2204, 2206, Macon County; soils 3935*, 3937, subsoils 1903 (clay underlying tobacco lands), 3936*, 3938*, Nash County; soils 3939, 3941, subsoils 3940*, 3942*, Northampton County; subsoil 1914, Wake County; soils 3954, 3987, 3989, 3991, subsoils 3955*, 3986, 3988, 3990, 3992, Washington County.

NORTH DAKOTA.

(61 samples.)

The samples from North Dakota were collected by agents of the United States Department of Agriculture.

[Mechanical analyses have been made of samples marked (*).]

Alkali (1 soil, 5 subsoils).

Soil 3293*, subsoils 3294*, 3296* (hardpan), 3749 (bad land), 3750 (bad land), 3751 (bad land), Morton County.

Alluvial. *See* Lacustrine.

Bad land (1 soil, 4 subsoils).

Soil 3748, subsoil 3752, Morton County.

See under Alkali for other samples.

Prairie (26 soils, 27 subsoils).

Jamestown Valley—wheat (4 soils, 7 subsoils).

Soils 3260*, 3263, 3266*, 3268*, subsoils 3261*, 3262*, 3264*, 3265*, 3267*, 3269*, 3270*, Stutsman County.

Mechanical analysis 3264, published in Yearbook, Department of Agriculture, 1897, page 440.

Lacustrine, alluvial soil (Red River Valley)—wheat (8 soils, 9 subsoils).

Soils 1858, 1860, 1862, 3278, 3280*, 3282*, 3753, subsoils 1859*, 1861*, 1863*, 3279*, 3281*, 3283*, 3961*, Cass County; soil 3271*, subsoils 3272*, 3273*, Ransom County.

Mechanical analysis 3279, published in Yearbook, Department of Agriculture, 1897, page 440.

Unclassified—wheat (14 soils, 11 subsoils).

Soils 3290*, 3292, subsoil 3291*, Burleigh County; soils 3274, 3276, 3284*, 3286, 3288, 3743, subsoils 3275*, 3277*, 3285*, 3287, 3289, 3744, 3745, Kidder County; soils 3295, 3298, 3746, subsoils 3297, 3299*, 3747, Morton County; soils 3300*, 3301*, 3302*, Stark County.

Mechanical analyses 3285, 3291, published in Yearbook, Department of Agriculture, 1897, page 440

Wheat land (26 soils, 27 subsoils).

See Prairie.

OHIO.

(74 samples.)

The samples from Ohio were collected by agents of the United States Department of Agriculture.

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil—corn, wheat (8 soils, 9 subsoils).

Soil 3092, subsoil 3093, Brown County; soils 703, 705, 707, subsoils 704, 706, 708, Franklin County; soils 3094, 3096, 3101, 3106, subsoils 3095, 3097, 3102, 3103, 3107, Montgomery County.

Clay, pottery (5 samples).

1978* (stoneware clay), Summit County; 1979* (crude kaolin), 1980* (washed kaolin), 1970* Franklin County, 1977* (stoneware clay), Perry County. Contributed by Prof. Edwin Orton.

Corn land (22 soils, 27 subsoils).

See Alluvial soil, glacial drift, limestone.

Glacial drift—cigar tobacco, wheat, corn (9 soils, 12 subsoils).

Soils 3098, 3104, 3108, 3110, 3113, 3115, 3117, 3119*, subsoils 3099*, 3100, 3105, 3109, 3111*, 3112, 3114, 3116, 3118, 3120*, 3121*, Montgomery County; soil 3732, subsoil 3733, Wayne County.

Mechanical analyses 3099, 3111, 3120, 3121, published in Bulletin No. 11, Division of Soils, page 41.

Grass land (5 soils, 6 subsoils).

See Limestone.

Greenhouse soil—lettuce, cucumbers (1 sample).

1983, Columbus.

Lake Erie bottom (from bottom of lake, collected to study the relation of lake bottom to vegetation) (16 soils).

Soils 3843*, 3844*, 3845*, 3846*, 3847*, 3848*, 3849*, 3850*, 3851*, 3852*, 3853*, 3854*, 3855*, 3856*, 3857*, 3858*, Ottawa County.

Limestone, Hudson River—White Burley tobacco, grass, wheat, corn (5 soils, 6 subsoils).
  Soils 3081, 3084, 3086, 3088, 3090, subsoils 3082*, 3083, 3085, 3087*, 3089*, 3091*, Brown County.
  Mechanical analyses, 3082, 3087, 3089, 3091, published in Bulletin No. 11, Division of Soils, page 44.
Tobacco land (14 soils, 18 subsoils).
  Cigar (9 soils, 12 subsoils).
    See Glacial drift.
  White Burley (5 soils, 6 subsoils).
    See Limestone.
Unclassified (1 soil, 2 subsoils).
  Soil 2965, subsoils 2966*, 2967*, Lawrence County.
Wheat land (22 soils, 27 subsoils).
  See Alluvial soil, glacial drift, limestone.

OKLAHOMA.

(15 samples.)

The samples from Oklahoma were collected by the Oklahoma Experiment Station in connection with the exhibit for the World's Fair exhibit at Chicago.

Unclassified (10 soils, 5 subsoils).
  Soil 1361 (prairie), Beaver County; soil 1358 (alluvium-prairie), subsoil 1359 (alluvium-prairie), Canadian County; subsoil 1107, Greer County; soils 1077, 1078, Kingfisher County; soils 964 (timber), 965 (blue stem), Logan County; soils 784, 786 (prairie), 788, subsoils 785, 787 (prairie), 790, Payne County; soil 795.

OREGON.

(2 samples.)

[Mechanical analyses have been made of the samples marked (*).]

Adobe, diabasic (2 soils).
  Soils 2810*, 2811*, Douglas County. Collected by agents of the United States Department of Agriculture.

PENNSYLVANIA.

(60 samples.)

The samples from Pennsylvania were collected by agents of the United States Department of Agriculture.

[Mechanical analyses have been made of samples marked (*).]

Clay, pottery (1 sample).
  1973* (ground feldspar), Delaware County. Contributed by Prof. Edwin Orton.
Greenhouse soil (17 samples).
  Carnations, roses.
    Soil 2230*, Avondale; soils 2251, 2252, Bloomsburg; soil 2314, Chestnut Hill; soils 2216*, 2217*, 2218*, 2219*, 2220*, 2223*, 2224*, 2793*, Kennett Square; soil 2211, Philadelphia.
  Tomatoes.
    Soils 2215*, 2221*, 2222*, 2225*, Kennett Square.
Grass land (12 soils, 12 subsoils).
  See Trenton limestone, shaly limestone.

Limestone (12 soils, 12 subsoils).

Trenton limestone, *see* Tobacco land (9 soils, 8 subsoils).

Shaly limestone, *see* Tobacco land (3 soils, 4 subsoils).

Potsdam sandstone—rye (1 subsoil).

Subsoil 2571, York County.

Tobacco lands (cigar type) (13 soils, 20 subsoils).

Phillite—tobacco, wheat (2 subsoils).

Subsoils 2511*, 2512*, York County.

River land—tobacco (1 soil, 1 subsoil).

Soil 2573*, subsoil 2574*, Lancaster County.

Trenton limestone—tobacco, wheat, grass (12 soils, 12 subsoils).

Soils 3, 11*, 1260, 1704, 1919, 1920, subsoils 10*, 16*, 1360*, 1705*, 2804*, Lancaster County; soils 2507*, 2509, 2569*, subsoils 2508*, 2510*, 2570*, York County.

Shaly limestone.

Soils 2513, 2515, 2567*, subsoils 2514*, 2516*, 2568*, 2572, Lancaster County.

Unclassified—tobacco (5 subsoils).

Subsoils 636, 637, 638, 639, 640*, Bradford County.

Mechanical analyses 16, 1360, published in Yearbook, Department of Agriculture, 1894, page 152. Mechanical analyses 10, 16, 1360, 1705, published in Report of Pennsylvania State College, 1894, Part II, page 144, and in Bulletin No. 5, Division of Soils, page 17. Mechanical analyses 16, 1360, 2508, 2510, 2511, 2514, 2516, 2568, 2570, 2574, 2804, published in Bulletin No. 11, Division of Soils, page 40.

Unclassified (8 samples).

1917, 1918, Bradford County; 683* (fresh molding sand), 727* (molding sand which has been used and is "dead"), 2575, 2576*, 2577*, 2578, Lancaster County.

Wheat land (12 soils, 14 subsoils).

See Trenton limestone, phillite.

RHODE ISLAND.

(19 samples.)

[Mechanical analyses have been made of samples marked (*).]

Carboniferous conglomerate (1 soil).

Soil 980, Providence County. Collected by agent of the Rhode Island Experiment Station.

Drift, glacial (5 soils, 5 subsoils).

Soil 974, subsoil 975, Kent County; soil 978, subsoil 979, Newport County; soil 972, subsoil 973, Providence County; soils 796, 981, subsoils 797, 982, Washington County. Collected by agents of the Rhode Island Experiment Station.

"Transition graywacke" (1 soil, 1 subsoil).

Soil 976, subsoil 977. Collected by agent of the Rhode Island Experiment Station.

Truck land (2 soils, 2 subsoils).

Soils 516*, 517, subsoils 522, 523*, Providence County. Collected by agents of the United States Department of Agriculture.

Mechanical analyses 516, 523, published in Yearbook, Department of Agriculture, 1894, page 143. Mechanical analysis 516, published in Bulletin No. 5, Division of Soils, page 16.

Unclassified (2 soils).

Soils 153*, 279*. Collected by agents of the Rhode Island Experiment Station.

RUSSIA.

(8 samples.)

[Mechanical analyses have been made of samples marked (*).]

Alkali (1 soil).

Soil 3697*, Turkestan. Collected by an agent of the United States Department of Agriculture.

Chernozem ("black earth")—wheat (4 soils, 3 subsoils).

Soil 2311*, subsoil 2308*, Alexandrovsk district, Ekaterinoslav government; soil 2312*, subsoil 2313*, Paulograd district, Ekaterinoslav government; soil 2307*, Elizabetgrad district, Kherson government; soil 2309*, subsoil 2310*, Melitopol district, Tavrich government. Collected in the great wheat-growing region by S. Kizenkoff, member of the irrigation commission for South Russia.

SOUTH CAROLINA.

(103 samples.)

The samples from South Carolina were collected by agents of the United States Department of Agriculture or the South Carolina Experiment Station, during the period when the station was located at Columbia.

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil—rice (6 soils, 1 subsoil).

Soils 24*, 25*, 26*, 27*, subsoil 30, Georgetown County; soil 3961*, Charleston County; soil 59*, Sumter County.

Mechanical analyses 24, 25, 26, 59, published in Report No. 6, Division of Statistics, Department of Agriculture, entitled "Rice, its cultivation, production, and distribution," pages 86, 89. Mechanical analysis 25 published in Rocks, Rock Weathering, and Soils, page 341.

Of these samples 59 represents the upland rice soil; 24 and 26 the very finest type of "alluvial mud," soft, black, and sticky, which forms the finest type of lowland rice lands; sample 25 represents the typical swamp bog or peat, which forms the poorest kind of rice land, being easily exhausted.

Clay, pottery (1 sample).

50 (kaolin), Aiken County.

Clay slate—cotton, corn, wheat (2 subsoils).

Subsoils 14*, 127*, Edgefield County.

Corn land (15 soils, 23 subsoils).

See "Provision land," hammock, Red Hill, gneiss, clay slate.

Cotton land (24 soils, 41 subsoils).

See Sea Island cotton, hammock, lower pine belt, upper pine belt, Red Hill, gneiss, clay slate.

Gneiss—wheat, corn, cotton (2 soils, 7 subsoils).

Soil 109, Abbeville County; subsoils 102, 103, 104, 105, 106, 107, Anderson County; soil 100, subsoil 101, Laurens County.

Hammock or ridge land—cotton, corn (5 soils, 5 subsoils).

Soils 65, 67, 68, 70, 79, subsoils 66, 69, 71, 72, 80, Williamsburg County.

Lower pine belt—cotton (2 soils, 5 subsoils).

Soils 121, 123, subsoils 60, 61, 62, 64, 122, Williamsburg County.

"Provision land"—corn (3 soils, 1 subsoil).

Soil 120*, Edisto Island; soils 12, 87, subsoil 88*, James Island.

Mechanical analysis 88, published in Yearbook, Department of Agriculture, 1894, page 136; also in Bulletin No. 4, Weather Bureau, page 43.

Red Hill formation—cotton, corn (5 soils, 8 subsoils).

Soils 91, 93, subsoils 92, 94, 97, Aiken County; soil 124, subsoils 125*, 2803*, Orangeburg County; soils 73, 75, subsoils 74*, 76*, 126, Sumter County.

Mechanical analyses 74, 76, published in Bulletin No. 4, Weather Bureau, page 46.

Sand Hills (3 soils, 9 subsoils).

Subsoils 96, 98, 99, Aiken County; soils 37, 38, subsoils 32, 33, 34, 35, 39, Richland County; soil 77, subsoil 78*, Sumter County.

Mechanical analysis 78 (a truck soil), published in Yearbook, Department of Agriculture, 1894, page 136; also in Bulletin No. 4, Weather Bureau, page 46.

Sea Island cotton and truck soil (10 soils, 12 subsoils, 1 sample mud).

Soils 110, 112, 114, 118, subsoils 111*, 113*, 115*, 116*, 119, Edisto Island; soils 1, 2, 81, 83, 85, 89 (salt land), subsoils 8, 9, 82*, 84*, 86*, 90 (salt land), 2807*, James Island; 13 (salt mud from marshes, used in the bottom of cotton rows as a fertilizer in the cultivation of Sea Island cotton), James Island.

Mechanical analyses 82, 84, 86, published in Yearbook, Department of Agriculture, 1894, page 136; also in Bulletin No. 4, Weather Bureau, page 43.

There are two important classes of soils on the Sea Islands: the cotton and truck soils, which usually form the rather narrow belt adjacent to the salt marshes; and the soils of the interior of the islands, which are frequently poorly drained and consequently unfit for the finest type of Sea Island cotton. This is known as "provision land," as it is on this, upon which the valuable crops of cotton can not be grown, that most of the common forage and other provisions for the plantation are grown. There are three general types of the Sea Island cotton soils, locally known as "sand and gravel," "clay lands," and "sandy lands." Samples 83 and 84 represent the sand and gravel from James Island, which is considered the very finest type of Sea Island soil. They contain a very small amount of very fine gravel or coarse sand which secures perfect drainage, while the clay they contain is sufficiently retentive of moisure to make them safe for crops. There is comparatively little of this type. Samples 8, 9, 81, and 82 represent the clay lands, containing, however, no more than 5 or 6 per cent of clay; while 1, 2, 85, and 86 represent the sandy lands with not over 1 or 2 per cent of clay. This slight difference in the amount of clay is clearly recognized by the planters and is indeed very apparent to anyone who examines the land. Under ordinary conditions the clay land is considered much finer than the sandy land, but under the conditions of intensive cultivation which prevail they are all about equally productive.

Talc-serpentine (1 soil, 3 subsoils).

Soil 48, subsoils 49, 51, Chester County; subsoil 47, Lancaster County.

Tobacco land (cigarette) (1 soil, 1 subsoil).

Soil 751*, subsoil 764*, Lancaster County. Collected under the direction of Dr. H. B. Battle, director of the North Carolina Experiment Station.

Mechanical analysis 764, published in Bulletin No. 21, Maryland Experiment Station, page 43; in Report of the State Board of Agriculture, Virginia, 1895, page 151; in Bulletin No. 5, Division of Soils, page 21, and in Bulletin No. 11, Division of Soils, page 43. Mechanical analysis 751, published in Bulletin No. 11, Division of Soils, page 43.

Trap (2 soils, 3 subsoils).

Soils 41, 44, subsoils 42 (pipe clay), 45, 46 (pipe clay), Chester County.

Unclassified (2 soils).

Soil 108, Abbeville County; soil 28, Georgetown County.

Upper pine belt—cotton (2 subsoils).

Subsoils 57, 58, Sumter County.

Wheat land (2 soils, 9 subsoils).

See Gneiss, clay slate.

SOUTH DAKOTA.

(11 samples.)

Prairie—wheat (3 soils, 8 subsoils).

Soil 1856, subsoil 1857, Beadle County; soils 3864, 3868, subsoils 3865, 3866, 3867, 3869, 3870, 3871, 3872, Brookings County. Collected by agents of the United States Department of Agriculture.

SUMATRA.

(12 samples.)

[Mechanical analyses have been made of samples marked (*).]

Tobacco land (cigar type) (3 soils, 9 subsoils).

Soils 2195*, 2197*, subsoils 2196*, 2198*, Behalla estate, Deli-Sumatra; soil 2207*, subsoil 2208*, Brahraug, Langhas-Sumatra; subsoils 2199*, 2200*, Rimboen estate; subsoils 2201*, 2202*, Tandjong Geonoeng estate; subsoils 2209*, 2210*, Tjermin Upper Lankat. Collected under the direction of the vice-consul at Padang.

Mechanical analysis 2200, published in Bulletin No. 5, Division of Soils, page 19.

TENNESSEE.

(131 samples.)

The samples from Tennessee were obtained through two sources. Part of them were collected by agents of the Tennessee Experiment Station while the soil collection for the Columbian Exposition at Chicago was being secured. The remaining samples were collected by agents of the United States Department of Agriculture. The samples collected by agents of the Tennessee Experiment Station form the basis of a bulletin upon the soils of Tennessee, issued in September, 1897. Mechanical analyses were made of these samples in the Division of Soils, and chemical analyses were made in the laboratory of the Tennessee Experiment Station.

[Mechanical analyses have been made of samples marked (*). Chemical analyses have been made of samples marked (°).]

Cambrian (3 soils, 2 subsoils).

Knox shale—wheat, corn, grass (1 soil, 1 subsoil).

Soil 715, subsoil 716*°, Monroe County. Collected by agents of the Tennessee Experiment Station.

Knox sandstone—tobacco, cigarette (2 soils, 1 subsoil).

Soil 778, subsoil 779*°, Greene County. Collected by agent of the Tennessee Experiment Station.

Soil 1931, Washington County. Collected by an agent of the United States Department of Agriculture.

Mechanical analysis 779, published in Bulletin No. 5, Division of Soils, page 20; Bulletin, Vol. 10, No. 3, Tennessee Experiment Station, page 133, and in report of the Virginia State Board of Agriculture, 1895, page 151.

Chemical analysis 779, published in Bulletin, Vol. X, No. 3, Tennessee Experiment Station, page 134.

Mechanical and chemical analysis 716, published in Bulletin, Vol. X, No. 3, Tennessee Experiment Station, pages 133, 134.

Coal measures (1 soil, 1 subsoil).

Soil 719, subsoil 720*○, Grundy County. Collected by agents of Tennessee Experiment Station.

Mechanical and chemical analysis 720, published in Bulletin, Vol. X, No. 3, Tennessee Experiment Station, pages 133–134.

Corn land (42 soils, 67 subsoils).

See Knox shale, Cretaceous, Lafayette, limestone, loess.

Cotton land (8 soils, 8 subsoils).

See Lafayette, Cretaceous, loess.

Cretaceous (flatwoods)—cotton, corn (2 soils, 2 subsoils).

Soil 730, subsoil 731*○, Benton County; soil 732, subsoil 733*○, Carroll County. Collected by agents of the Tennessee Experiment Station.

Mechanical and chemical analyses 731, 733, published in Bulletin, Vol. X, No. 3, Tennessee Experiment Station, pages 133–135.

Grass land (34 soils, 59 subsoils).

See Knox shale, limestone.

Lafayette (orange sands)—export tobacco, cotton, corn (5 soils, 5 subsoils).

Soil 736, subsoils 737*○, Fayette County; soil 734, subsoil 735*○, Gibson County. Collected by agents of the Tennessee Experiment Station.

Soils 3184, 3186, 3188, subsoils 3185, 3187, 3189, Henry County. Collected by agents of the United States Department of Agriculture.

Mechanical and chemical analyses 735, 737, published in Bulletin, Vol. X, No. 3, Tennessee Experiment Station, pp. 133–135.

Limestone (33 soils, 58 subsoils).

Knox dolomite—export tobacco, grass, wheat, corn (3 soils, 3 subsoils).

Soils 462, 709, 711, subsoils 463*, 710*○, 712*○, Knox County. Collected by agents of the Tennessee Experiment Station.

Lenore limestone—export tobacco, grass, wheat, corn (2 soils, 2 subsoils).

Soil 464, subsoil 465, Knox County; soil 713, subsoil 714*○, Loudon County. Collected by agents of the Tennessee Experiment Station.

Nashville limestone (blue-grass region)—White Burley tobacco, grass, wheat, corn (1 soil, 1 subsoil).

Soil 723, subsoil 724*○, Maury County. Collected by agents of the Tennessee Experiment Station.

Trenton limestone (blue-grass region)—White Burley tobacco, wheat, corn (4 soils, 6 subsoils).

Subsoil 1703, Bradley County; soils 1871, 1873, 1874, 1929, subsoils 1718*, 1872, 1875, 1876, 1930, Davidson County. Collected by agents of the United States Department of Agriculture.

St. Louis group—export tobacco, grass, wheat, corn (23 soils, 46 subsoils).

Soil 717, subsoil 718*○, Franklin County; soil 725, subsoil 726*○, Robertson County. Collected by agents of the Tennessee Experimemt Station.

Soils 1878, 1879, 1880*, 1932, 2590, 2593, 2597, 2600, 2604, 2607, 2610, 2614, 2618, subsoils 1719*, 1720*, 1881, 2591*, 2592*, 2594*, 2595, 2596, 2598*, 2599*, 2601*, 2602*, 2603, 2605*, 2606*, 2608*, 2609*, 2611*, 2612*, 2613, 2615*, 2616, 2617, 2619*, 2620*, 2621, Montgomery County; soils 2622, 2626, 2628, 2632, 2635, 2637, 2641, 2644, subsoils 2623*, 2624*, 2625, 2627, 2629*, 2630*, 2631, 2633*, 2634, 2636*, 2638*, 2639, 2640, 2642*, 2643, 2645*, 2646*, 2647*, Robertson County. Collected by agents of the United States Department of Agriculture.

Mechanical analysis 1720, published in Bulletin No. 5, Division of Soils, page 22, and in Bulletin No. 11, Division of Soils, page 46. Mechanical analyses 726, 1719, 1880, 2591, 2592, 2594, 2598, 2599, 2601, 2602, 2605, 2606, 2608, 2609, 2611, 2612, 2615, 2619, 2620, 2623, 2624, 2629, 2630, 2633, 2636, 2638, 2642, 2645, 2646, 2647, published in Bulletin No. 11, Division of Soils, pages 45–47.

Mechanical and chemical analyses 710, 712, 714, 718, 724, 726, published in Bulletin, Vol. X, No. 3, Tennessee Experiment Station, pages 133–135.

Loess—cotton, corn (1 soil, 1 subsoil).
Soil 738, subsoil 739*°, Dyer County. Collected by agents of the United States Department of Agriculture.
Mechanical and chemical analysis 739, published in Bulletin, Vol. X, No. 3, Tennessee Experiment Station, pages 133–135.
Subcarboniferous (30 soils, 54 subsoils).
St. Louis group (23 soils, 46 subsoils).
See under Limestone.
Siliceous group, Keokuk—barrens (1 soil, 1 subsoil).
Soil 721, subsoil 722*°, Coffee County. Collected by agents of the Tennessee Experiment Station.
Mechanical and chemical analysis 722, published in Bulletin, Vol. X, No. 3, Tennessee Experiment Station, pages 133–135.
Unclassified (6 soils, 7 subsoils).
Subsoil 3610*, Montgomery County; soils 3146, 3148, 3150, 3152, 3154, 3156, subsoils 3147, 3149, 3151, 3153, 3155, 3157, Robertson County. Collected by agents of the United States Department of Agriculture.
Tobacco land (40 soils, 66 subsoils).
Cigarette (2 soils, 1 subsoil).
See Knox sandstone.
Export type (33 soils, 56 subsoils).
See Knox dolomite, Lafayette, Lenore limestone, St. Louis group.
White Burley (5 soils, 7 subsoils).
See Nashville limestone, Trenton limestone.
Unclassified (1 soil, 1 subsoil).
Soil 2943*, subsoil 2944*, Lewis County. Collected by agents of the United States Department of Agriculture.
Wheat land (34 soils, 59 subsoils).
See Knox shale, limestone.

TEXAS.

(29 samples.)

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil (2 soils, 1 subsoil).
Soil 2698, Uvalde County. Collected by the United States Geological Survey.
Soil 2244*, subsoil 2245*, Galveston County. J. S. Dolen, collector.
Basalt (1 soil).
Soil 2699*, Uvalde County. Collected by the United States Geological Survey.
Black waxy, probably Cretaceous (3 soils, 2 subsoils).
Soils 2565*, 2945*, subsoils 2566*, 2946*, Lamar County; soil 2143* ("Eagle Ford clay"), Tarrant County. Collected by agents of the United States Department of Agriculture.
Permian—wheat land (1 soil, 1 subsoil).
Soil 3698, subsoil 3699, Taylor County. Collected by agents of the United States Department of Agriculture.
Prairie (2 soils, 2 subsoils).
Soils 2165*, 2167*, subsoils 2166*, 2168*, Harris County. J. S. Dolen, collector.
Silt terrace of the Nueces River (2 soils).
Soils 2697*, 2700*, Uvalde County. Collected by agents of the United States Geological Survey.
Tobacco land (cigar type), (3 soils, 3 subsoils).
Soils 2281, 2283, 2285, subsoils 2282*, 2284*, 2286*, Montgomery County. Collected by agents of the United States Department of Agriculture.
Mechanical analyses 2282, 2284, 2286, published in Bulletin No. 11, Division of Soils, page 42.

Unclassified (3 soils, 3 subsoils).

Soils 3819, 3822, 3823, subsoils 3820, 3821, 3824, Montague County. Collected by S. P. Benton.

UTAH.

(4 samples.)

[Mechanical analyses have been made of samples marked (*).]

Bench land (2 soils).

Soils 3426*, 3429*, Salt Lake County. Collected by agents of the United States Department of Agriculture.

Valley land (2 soils).

Soils 3427, 3428*, Salt Lake County. Collected by agents of the United States Department of Agriculture.

VERMONT.

(1 sample.)

[Mechanical analysis has been made of sample marked (*).]

Greenhouse soil—carnations, roses (1 sample).

Soil 2229*, Manchester.

VIRGINIA.

(279 samples.)

All the samples from Virginia were collected by agents of the United States Department of Agriculture. Most of them were collected at the request of and in cooperation with the Virginia State Board of Agriculture.

[Mechanical analyses have been made of samples marked (*).]

Alluvial soil (Dismal Swamp land)—corn (7 soils, 21 subsoils).

Subsoils 3829, 3830, 3831, Nansemond County; soils 3825, 3826, 3836, 3839, 3921*, 3924*, 3929*, subsoils 3832, 3833, 3834, 3835, 3837, 3838, 3840, 3922*, 3923*, 3925*, 3926*, 3927, 3928*, 3930*, 3931*, 3932, 3933*, 3934, Norfolk County.

Barrens of Caroline and Hanover counties—"pipe clay" (1 soil, 13 subsoils).

Subsoils 2127*, 2141*, 2142*, Caroline County; soil 2130*, subsoil 2131* (crayfish land), 2132* (crayfish land), 2133* (crayfish land), 2134*, 2135*, 2136*, 2137*, 2138*, 2139*, 2140* (near Beaverdam), Hanover County.

Mechanical analyses 2130, 2131, 2132, 2133, 2134, 2135, published in Report of Virginia State Board of Agriculture, 1895, page 167.

Corn land (40 soils, 87 subsoils).

See Alluvial soil, limestone, tobacco land.

Diabase (1 soil).

Soil 3640*, Pittsylvania County.

Mechanical analysis published in The American Geologist, Vol. XXII, No. 2, August, 1898, page 92.

Grass land (28 soils, 57 subsoils).

See Limestone, tobacco land.

Limestone, Trenton—wheat, corn, grass (19 soils, 34 subsoils).

Soils 2001, 2007, 2057, subsoils 2002*, 2008, 2058*, Frederick County; subsoils 657*, 2805*, Montgomery County; soils 449, 485, subsoils 450*, 486*, 624*, 625*, 626*, 627*, Page County; subsoils 632*, 633*, 634*, 635*, Rockingham County; soils 457*, 459, 461, 487*, 489, 620, 622*, 1998, 1999, 2003, 2005, 2033, 2036, 2039, subsoils 458*, 460*, 484*, 488*, 619*, 621*, 623*, 628*, 629*, 630*, 631*, 2000*, 2004*, 2006*, 2034*, 2035*, 2037*, 2038*, 2040*, Shenandoah County.

Limestone, Trenton—wheat, corn, grass (19 soils, 34 subsoils)—Continued.

Mechanical analyses 458, 460, 484, 486, 488, 619, 623, 624, 625, 626, 628, 629, 630, 631, 632, 633, 634, 635, 657, 2002, 2004, 2034, 2035, 2037, 2038, 2040, 2058, published in Report of Virginia State Board of Agriculture, 1895, pages 164–165.

Tobacco land (41 soils, 75 subsoils).

Bright tobacco, cigarettes, and plug wrappers (27 soils, 43 subsoils).

Soils 2065, 2067, subsoils 2066*, 2068*, 2069*, Brunswick County; soil 740, subsoil 753* (collected under the direction of Dr. H. B. Battle, director of the North Carolina Experiment Station), Halifax County; soil 2121*, subsoils 2122*, 2123*, 2124*, Hanover County; soils 1890, 1892, 1894, subsoils 1891, 1895, Henry County; soils 2026, 2029, 2041, 2044, 2046, 2048, 2051, 2054, subsoils 2027*, 2028*, 2030*, 2031*, 2032*, 2042*, 2043*, 2045*, 2047*, 2049*, 2050*, 2052*, 2053*, 2055, Mecklenburg County; soils 690, 693, 695, 698, 819, 1341, 1592, 1653, 1666, 1669, 1774, 1896, subsoils 691, 692*, 694*, 696*, 697*, 789*, 814*, 1329*, 1334*, 1372*, 1459*, 1605*, 1639*, 1663*, 1667*, 1668*, 1722*, 1751*, 1833*, 1897, Pittsylvania County.

Mechanical analysis 1372, published in Bulletin No. 5, Division of Soils, page 21; also in Report of Virginia State Board of Agriculture, 1895, page 154. Mechanical analyses 692, 694, 696, 697, 753, 789, 814, 1329, 1334, 1459, 1605, 1639, 1663, 1667, 1668, 1722, 1751, 1833, 2027, 2028, 2030, 2031, 2032, 2043, 2045, 2047, 2049, 2050, 2052, 2053, 2055, 2066, 2068, published in Report of Virginia State Board of Agriculture, 1895, pages 153–157. Mechanical analyses 694, 696, 753, 789, 1329, 1372, 1605, 1663, 1667, 1668, 1722, 1751, 1833, 2027, 2028, 2030, 2031, 2032, 2045, 2047, 2049, 2052, 2066, 2068, published in Bulletin No. 11, Division of Soils, page 43.

Export and manufacturing types—wheat, corn, grass (9 soils, 23 subsoils).

Gabbro soils (4 soils, 6 subsoils).

Soils 641*, 643*, 645, 648, subsoils 642*, 644*, 646*, 647*, 649*, 650*, Albemarle County.

Gneiss soil (2 soils, 8 subsoils).

Soils 2340*, 3959*, Albemarle County; subsoils 655*, 656*, 658*, 659*, Bedford County; subsoils 651*, 652*, 653*, 654*, Campbell County.

Unclassified (3 soils, 9 subsoils).

Soils 2059, 2061, 2063, subsoils 2060*, 2062*, 2064*, Brunswick County; subsoil 1997*, Charlotte County; subsoil 1893, Henry County; subsoil 2056*, Mecklenburg County; subsoils 814, 1664*, 1665*, Pittsylvania County.

Mechanical analyses 642, 644, 646, 647, 649, 650, 651, 652, 653, 654, 655, 656, 658, 659, 1664, 1665, 1997, 2056, 2060, 2062, 2064, published in Report of Virginia State Board of Agriculture, 1895, pages 159–162, and in Bulletin No. 11, Division of Soils, page 44.

Sun-cured tobacco, manufacturing types—wheat, corn (5 soils, 9 subsoils).

Soils 2125*, 2128*, subsoils 2126*, 2129*, Hanover County; soils, 2016, 2019, 2022, subsoils 2017*, 2018*, 2020*, 2021*, 2023*, 2024*, 2025*, Louisa County.

Mechanical analyses 2017, 2018, 2020, 2021, 2023, 2024, 2025, published in Report of Virginia State Board of Agriculture, 1895, page 169.

Truck land, Columbia (23 soils, 31 subsoils).

Soils 366*, 368, 370, 373*, 375, 377, 380*, 383, 385, 2009, 2012, subsoils 367*, 369*, 371*, 372*, 374*, 376, 378*, 379*, 381*, 384*, 386*, 387*, 2010*, 2011*, 2013*, 2014*, James City County; soils 354*, 356, 358, 360, 362, 364, 1588, 1590, 1594*, 1596, 1598, 1600, subsoils 355*, 357*, 359*, 361*, 363*, 365*, 1589, 1591, 1593*, 1595*, 1597, 1599*, 1601*, 3827, 3828, Norfolk County.

Truck land, Columbia (23 soils, 31 subsoils)—Continued.

Mechanical analyses 1593, 1595, 1599, 1601, published in Yearbook, Department of Agriculture, 1894, page 138. Mechanical analysis 1595, published in Bulletin No. 5, Division of Soils, page 16; also published in Bulletin No. 129, North Carolina Experiment Station, 1896, page 174. Mechanical analysis 371, published in Bulletin No. 3, Division of Soils, page 6. Mechanical analyses 355, 357, 359, 361, 363, 365, 367, 369, 371, 372, 374, 378, 379, 381, 384, 386, 387, 1593, 1595, 1599, 1601, 2010, 2011, 2013, 2014, published in Report of Virginia State Board of Agriculture, 1895, pages 147–150.

Unclassified (6 soils, 7 subsoils).

Soils 1706*, 1708*, 1710*, subsoils 1707*, 1709*, 1711*, Albemarle County; soils 2182*, 3859*, subsoils 2183*, 3860*, 3861*, Fairfax County; subsoil 382, James City County; soil 1898*, Spottsylvania County.

Wheat land (33 soils, 66 subsoils).

See Limestone, tobacco land.

WASHINGTON.

(58 samples.)

The samples from Washington were collected by agents of the Experiment Station for the World's Fair exhibit at Chicago.

[Mechanical analyses have been made of samples marked (*).]

Alkali (2 soils, 1 subsoil).

Soils 3339, 3340, subsoil 3341*, Wallawalla County.

Alluvial soil (8 soils, 4 subsoils).

Soil 1050, Clallam County; soil 985, subsoil 986, Clarke County; soil 1006, subsoil 1007, Pacific County; soil 991, subsoil 992, Pierce County; soil 1051, San Juan County; soil 990, Skagat County; soil 983, subsoil 984, Whatcom County; soil 1005, Whitman County.

Basalt—wheat (13 soils, 16 subsoils).

Subsoil 2921*, Garfield County; soils 3342, 3344, 3346*, 3348*, 3350, 3352* (foothills), 3354, subsoils 3343, 3345*, 3347*, 3349*, 3351*, 3353 (foothills), 3355 (foothills), Wallawalla County; soils 1003, 3330, 3332, 3334, 3336, subsoils 1004, 3331*, 3333*, 3335*, 3337*, 3338, 3956*, Whitman County; soil 3324, subsoil 3325*, Yakima County.

Mechanical analyses 3331, 3348, 3352, published in Yearbook, Department of Agriculture, 1897, page 440. Mechanical analysis 2921, published in Water-Supply and Irrigation Papers, No. 4, 1897.

Unclassified (5 soils, 3 subsoils).

Soil 2279, subsoil 2280, King County; soil 987, subsoil 988, Lewis County; soil 1008, Lincoln County; soil 1002, Stevens County; soil 3329*, Hunts Junction; subsoil 3356*, Wallawalla County.

Volcanic ash (5 soils, 1 subsoil).

Soil 1023, Kittitas County; soil 993, Wallawalla County; soils 1022, 3326, 3328, subsoil 3327*, Yakima County.

WEST VIRGINIA.

(11 samples.)

The samples from West Virginia were collected by agents of the United States Department of Agriculture.

[Mechanical analyses have been made of samples marked (*).]

Carboniferous sandstone (1 soil, 1 subsoil).

Soil 2951, subsoil 2952*, Cabell County.

Sandstone (3 subsoils).

Subsoils 229, 230, 232, Jefferson County.

Tobacco land (cigarette) (1 soil, 1 subsoil).

Soil 743*, subsoil 756*, Fayette County.

Mechanical analysis 756, published in Bulletin No. 21, Maryland Experiment Station, page 43; also in Report of Virginia State Board of Agriclture, 1895, page 151.

Unclassified (1 soil, 3 subsoils).

Soil 2953, subsoil 2954*, Cabell County; subsoil 2955*, North Barboursville Station; subsoil 911, Morgan County.

WISCONSIN.

(18 samples.)

The samples from Wisconsin were collected by agents of the United States Department of Agriculture.

[Mechanical analyses have been made of samples marked (*).]

Tobacco land (cigar type)—wheat, corn (8 soils, 10 subsoils).

Limestone (1 soil, 1 subsoil).

Soil 1497, subsoil 1498*, Rock County.

Oak openings (4 soils, 5 subsoils).

Soils 3252*, 3258*, subsoils 3253*, 3254*, 3259*, Dane County; soils 3244, 3250, subsoils 3245*, 3251*, Rock County.

Prairie (3 soils, 4 subsoils).

Soil 3256, subsoils 3255*, 3257*, Dane County; soils 3246, 3248, subsoils 3247*, 3249*, Rock County.

Mechanical analyses 1498, 3245, 3247, 3249, 3251, 3253, 3254, 3255, 3257, 3259, published in Bulletin No. 11, Division of Soils, page 41.

LIST OF PUBLICATIONS CONTAINING REFERENCES TO THE MECHANICAL OR CHEMICAL ANALYSES OF SAMPLES IN THIS COLLECTION.

Cotton Production of Alabama, Eugene A. Smith. Tenth Census, Vol. VI, 1880.

Cotton Production of California, E. W. Hilgard. Tenth Census, Vol. VI, 1880.

Geological Survey of Alabama: Agricultural Features of the State, Eugene A. Smith. 1881-82.

Soil Investigations, Milton Whitney. Fourth Annual Report of the Maryland Experiment Station, 1891.

Some Physical Properties of Soils in their Relation to Moisture and Crop Production, Milton Whitney. Weather Bureau Bulletin No. 4, 1892.

The Soils of Maryland, Milton Whitney. Bulletin No. 21, Maryland Experiment Station, 1893.

Agriculture and Live Stock, Milton Whitney. Maryland: Its Resources, Industries, and Institutions, 1893.

Rice: Its Cultivation, Protection, and Distribution in the United States and Foreign Countries, Amory Austin. With a chapter on the Rice Soils of South Carolina, Milton Whitney. Report No. 6, Division of Statistics, 1893.

Report of the Illinois Board of World's Fair Commissioners, 1893.

The Experiment Station at Bernburg, Germany, and its Methods of Sand Culture, H. Hellriegel. Experiment Station Record, Vol. V, No. 8, 1893-94.

Relation of Soils to Crop Production, Milton Whitney. Yearbook, Department of Agriculture, 1894.

The Soil of Lancaster County Limestone Belt in its Relation to Tobacco Culture, William Frear. Report of the Pennsylvania State College, 1894.

Further Investigations on the Soils of Maryland, Milton Whitney and Sothoron Key. Bulletin No. 29, Maryland Experiment Station, 1894.

Principles and Practice of Agricultural Analysis, Dr. H. W. Wiley. Vol. I, No. 6, 1894.

The Growth of Lettuce as Affected by the Physical Properties of the Soil, B. T. Galloway. Agricultural Science, Vol. VIII, Nos. 6–9, 1894.

The Water Content of Soils during the Month of July, Milton Whitney. Bulletin No. 3, Division of Soils, 1895.

Notes by the Editor, Cleveland Abbe. Monthly Weather Review, January, 1895.

Preliminary Report of the Soils of Virginia, Milton Whitney. Report of the State Board of Agriculture of Virginia, 1895.

Horticultural Experiments at Southern Pines, 1895. Bulletin No. 129, North Carolina Agricultural Experiment Station.

Texture of Some Important Soil Formations, Milton Whitney. Bulletin No. 5, Division of Soils, 1896.

Some Interesting Soil Problems, Milton Whitney. Yearbook, Department of Agriculture, 1897.

Rocks, Rock Weathering, and Soils, Geo. P. Merrill. 1897.

The Soils of Tennessee, Chas. F. Vanderford. Bulletin, Vol. X, No. 3, Tennessee Experiment Station, 1897.

A Reconnoissance in Southeastern Washington, I. C. Russell. Water-Supply and Irrigation Papers of the United States Geological Survey, No. 4, 1897.

Tobacco Soils of the United States: A Preliminary Report upon the Soils of the Principal Tobacco Districts, Milton Whitney. Bulletin No. 11, Division of Soils, 1898.

A Preliminary Report on the Soils of Florida, Milton Whitney. Bulletin No. 13, Division of Soils, 1898.

The Alkali Soils of the Yellowstone Valley, from a Preliminary Investigation of the Soils near Billings, Montana, Milton Whitney and Thos. H. Means. Bulletin No. 14, Division of Soils, 1898.

A Report to Congress on Agriculture in Alaska; including reports by W. H. Evans, Benton Killin, and Sheldon Jackson. Bulletin No. 48, Office of Experiment Stations, 1898.

Weathering of Diabase near Chatham, Virginia, Thos. L. Watson. The American Geologist, Vol. XXII, No. 2, August, 1898.

LIST OF SOIL SAMPLES, ARRANGED SERIALLY.

The following is a list of the samples in the collection of the Division of Soils, arranged in the order of their serial numbers from 1 to 4000, with references to the pages of this bulletin on which data regarding the samples may be found:

List of the soil samples, arranged serially from 1 to 4000.

No. of sample.	Classification.	Page in this bulletin.
1–2	Sea Island cotton and truck soil, South Carolina	62
3	Tobacco land—Trenton limestone, Pennsylvania	60
4	Truck land, Maryland	48
5–6	Tobacco land (cigar type), Cuba	31
7	Truck land, Maryland	48
8–9	Sea Island cotton and truck soil, South Carolina	62
10–11	Tobacco land—Trenton limestone, Pennsylvania	60
12	"Provision land," South Carolina	61
13	Sea Island cotton and truck soil, South Carolina	62
14	Clay slate, South Carolina	61
15	Greenhouse soil, Massachusetts	50
16	Tobacco land—Trenton limestone, Pennsylvania	60

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
17	Truck land, Maryland	48
18	Truck land, New York	56
19	Tobacco land (cigarette), North Carolina	57
20–23	Truck land, New York	56
24–27	Alluvial soil (rice land), South Carolina	61
28	Unclassified, South Carolina	62
29	Truck land, New York	56
30	Alluvial soil (rice land), South Carolina	61
31	Truck land, New York	56
32–35	Sand Hills, South Carolina	62
36	Truck land, New York	56
37–39	Sand Hills, South Carolina	62
40	Gneiss, North Carolina	56
41	Trap, South Carolina	62
42	Trap (pipe clay), South Carolina	62
43	Truck land, New York	56
44–45	Trap, South Carolina	62
46	Trap (pipe clay), South Carolina	62
47–49	Talc, South Carolina	62
50	Clay, pottery (kaolin), South Carolina	61
51	Talc, South Carolina	62
52–54	Gneiss, North Carolina	56
55–56	Truck land, New York	56
57–58	Upper pine belt, South Carolina	62
59	Alluvial soil (rice land), South Carolina	61
60–62	Lower pine belt, South Carolina	61
63	Greenhouse soil, Massachusetts	50
64	Lower pine belt, South Carolina	61
65–72	Hammock (ridge land), South Carolina	61
73–76	Red Hill formation, South Carolina	62
77–78	Sand Hills, South Carolina	62
79–80	Hammock (ridge land), South Carolina	61
81–86	Sea Island cotton and truck soil, South Carolina	62
87–88	"Provision land," South Carolina	61
89–90	Sea Island cotton and truck soil, South Carolina	62
91–94	Red Hill formation, South Carolina	62
95	Truck land, Massachusetts	50
96	Sand Hills, South Carolina	62
97	Red Hill formation, South Carolina	62
98–99	Sand Hills, South Carolina	62
100–107	Gneiss, South Carolina	61
108	Unclassified, South Carolina	62
109	Gneiss, South Carolina	61
110–116	Sea Island cotton and truck soil, South Carolina	62
117	Tobacco land (cigarette), North Carolina	57
118–119	Sea Island cotton and truck soil, South Carolina	62
120	"Provision land," South Carolina	61
121–123	Lower pine belt, South Carolina	61
124–126	Red Hill formation, South Carolina	62
127	Clay slate, South Carolina	61
128–129	Gneiss, Maryland	45
130	Limestone, Trenton and Hudson River, Kentucky	40
131–133	Gabbro, Maryland	45
134	Serpentine, Maryland	47
135–136	Quartzite, Maryland	47
137–139	Trenton limestone, Maryland	46
140–143	Chesapeake, Maryland	44
144–148	Truck land, Maryland	48
149	Unclassified, Maryland	49
150	Eocene marl—glauconite, Maryland	47
151	Miocene marl, Maryland	47
152	Chesapeake (diatomaceous earth), Maryland	44
153	Unclassified, Rhode Island	60
154–156	Chesapeake, Maryland	44
157	Truck—Chesapeake, Maryland	48
158–164	Chesapeake, Maryland	44
165–171	Truck—Eocene, Maryland	48
172–174	Trenton limestone, Maryland	46
175–177	Triassic red sandstone, Maryland	47
178–180	Chesapeake, Maryland	44
181	Chesapeake (diatomaceous earth), Maryland	44
182–184	Chesapeake, Maryland	44
185	Chesapeake (diatomaceous earth), Maryland	44
186	Miocene marl, Maryland	47
187	Truck land, Massachusetts	50
188–192	Miocene marl, Maryland	47
193–194	Eocene marl—glauconite, Maryland	47
195	Alluvial soil, Massachusetts	49

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
196–197	Eocene marl, Maryland	47
198–208	Columbia, Lower—river terrace, Maryland	45
209	Truck—Lafayette, Maryland	48
210	Lafayette—pine barrens, Maryland	46
211	Cretaceous marl, Maryland	47
212	Unclassified—quicksand, Maryland	49
213	Cretaceous marl, Maryland	47
214	Eocene marl, Maryland	47
215–219	Phillite, Maryland	47
220–225	Helderberg limestone, Maryland	46
226–228	Oriskany, Maryland	47
229–230	Sandstone, West Virginia	69
231	Trenton limestone, Maryland	46
232	Sandstone, West Virginia	69
233	Salina sandstone, Maryland	47
234–237	Hamilton-Chemung, Maryland	45
238	Catskill, Maryland	44
239–240	Clinton-Niagara, Maryland	44
241–244	Catoctin granite, Maryland	44
245–266	Chesapeake, Maryland	44
267–273	Truck land, Maryland	48
274	Eocene marl, Maryland	47
275	Unclassified, Maryland	49
276	Lafayette—pine barrens, Maryland	46
277	Limestone, Trenton and Hudson River, Kentucky	40
278	Columbia, Lower—river terrace, Maryland	45
279	Unclassified, Rhode Island	60
280	Chesapeake, Maryland	44
281	Truck land, Maryland	48
282	Triassic red sandstone, Maryland	47
283–284	Truck land, Maryland	48
285	Limestone, Trenton and Hudson River, Kentucky	40
286	Chesapeake, Maryland	44
287	Limestone, Trenton and Hudson River, Kentucky	40
288	Helderberg limestone, Maryland	46
289	Hamilton-Chemung, Maryland	45
290	Oriskany, Maryland	47
291–292	Limestone—gunpowder lime land, Alabama	23
293–294	Unclassified, Alabama	24
295–298	Limestone, Trenton and Hudson River, Kentucky	40
299–302	Prairie, Illinois	36
303	Clay, stoneware, Maryland	44
304–305	Clay, tile, Maryland	44
306–311	Tobacco land (cigar type), Cuba	31
312–317	Trenton limestone, Maryland	46
318–321	Chesapeake, Maryland	44
322	Prairie, Kansas	38
323	Prairie—black waxy soil, Kansas	38
324–326	Prairie (corn land), Kansas	38
327	Adobe, California	27
328	Fresno Plains, California	27
329–330	Tulare Plains, California	28
331	Unclassified (salt grass soil), California	29
332–333	Unclassified (red chaparral), California	29
334–335	Wheat land, California	29
336	Adobe, California	27
337	Mojave Desert, California	28
338	Unclassified—fruit land of southern California (mesa), California	28
339	Unclassified—fruit land of southern California, California	28
340	Unclassified (red chaparral), California	29
341–343	Adobe, California	27
344	Unclassified, California	29
345	Alkali land, California	27
346	Tulare Plains (wire-grass soil), California	28
347	Diabase, Massachusetts	50
348–353	Prairie, Nebraska	54
354–381	Truck land, Virginia	67
382	Unclassified, Virginia	68
383–387	Truck land, Virginia	67
388–391	Prairie—loess, Nebraska	53
392–395	Prairie, Nebraska	54
396–397	Prairie—Benton limestone, Kansas	37
398	Prairie—plains marl, Kansas	38
399	Prairie—blue-stem soil, Kansas	38
400–401	Prairie—plains marl, Kansas	38
402	Alluvial soil, Kansas	37
403	Prairie—blue-stem soil, Kansas	38
404–405	Prairie—plains marl, Kansas	38

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
406	Prairie, Kansas	38
407	Prairie—gypsum soil, Kansas	38
408–410	Prairie, Kansas	38
411–412	Prairie—plains marl, Nebraska	53
413	Prairie, Nebraska	54
414	Prairie—plains marl, Nebraska	53
415–416	Prairie, Nebraska	54
417–418	Prairie—loess, Nebraska	53
419–420	Prairie—Cretaceous (Colorado group), Nebraska	53
421–422	Prairie, Nebraska	54
423–424	Prairie—loess, Nebraska	53
425–426	Prairie—plains marl, Kansas	38
427–428	Prairie—Benton limestone, Kansas	37
429–430	Prairie—blue-stem soil, Kansas	38
431–435	Prairie—plains marl, Kansas	38
436–438	Shales (rye land), New York	56
439–442	Prairie—plains marl, Kansas	38
443	Unclassified, Alabama	24
444	Truck—Eocene, Maryland	48
445–446	Prairie—Benton limestone, Kansas	37
447–448	Prairie—Dakota sandstone, Kansas	38
449–450	Limestone, Trenton; Virginia	66
451–454	Prairie—Benton limestone, Kansas	37
455–456	Alluvial soil, Kansas	37
457–461	Limestone, Trenton; Virginia	66
462–463	Limestone—Knox dolomite, Tennessee	64
464–465	Lenore limestone, Tennessee	64
466–479	Truck land, Maryland	48
480	Chesapeake, Maryland	44
481	Truck land, Maryland	48
482	Unclassified, Maryland	49
483	Clay, pottery, Maryland	44
484–489	Limestone, Trenton; Virginia	66
490–491	Limestone, St. Louis ("red lands"), Alabama	23
492–495	Lafayette (orange sands), Alabama	23
496–497	Limestone, St. Louis ("red lands"), Alabama	23
498–499	Lafayette (orange sands), Alabama	23
500	Alluvial soil, Massachusetts	49
501	Truck land, Massachusetts	50
502–507	Lafayette (orange sands), Alabama	23
508	Truck land, Massachusetts	50
509	Limestone—Knox dolomite, Alabama	23
510–511	Cambrian shale, Alabama	22
512–515	Lafayette (orange sands), Alabama	23
516–517	Truck land, Rhode Island	60
518–519	Lafayette (orange sands), Alabama	23
520–521	Cretaceous, Alabama	22
522–523	Truck land, Rhode Island	60
524–525	Limestone, St. Louis ("red lands"), Alabama	23
526–527	Lafayette (orange sands), Alabama	23
528	Truck land, New York	56
529	Gneiss—hornblendic, Alabama	23
530–531	Lafayette (orange sands), Alabama	23
532	Truck land, New York	56
533	Lafayette (orange sands), Alabama	23
534–535	Limestone—Knox dolomite, Alabama	23
536–537	Lafayette (orange sands), Alabama	23
538–539	Truck land, New York	56
540–541	Gneiss, Alabama	23
542–543	Limestone—Knox dolomite, Alabama	23
544–547	Lafayette (orange sands), Alabama	23
548–549	Gneiss, Alabama	23
550–551	Lafayette (orange sands), Alabama	23
552–553	Coal measures, Alabama	22
554–555	Lafayette (orange sands), Alabama	23
556	Truck land, New York	56
557	Lafayette (orange sands), Alabama	23
558–559	Truck land, New York	56
560–591	Truck land, Maryland	48
592	Clay, brick, Maryland	44
593–597	Truck land, Maryland	48
598–610	Chesapeake, Maryland	44
611	Gumbo, New Mexico	55
612	Adobe, New Mexico	55
613–614	Mesa soil, New Mexico	55
615	Dead land (coarse), New Mexico	55
616–618	Truck land, New York	56
619–635	Limestone, Trenton; Virginia	66

List of the samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
636–640	Tobacco land (cigar type), Pennsylvania	60
641–650	Tobacco land (manufacturing and export)—gabbro, Virginia	67
651–656	Tobacco land (manufacturing and export)—gneiss, Virginia	67
657	Limestone, Trenton; Virginia	66
658–659	Tobacco land (manufacturing and export)—gneiss, Virginia	67
660–661	Prairie—Benton limestone, Kansas	37
662–663	Cambrian shales, Alabama	22
664–667	Limestone—Knox dolomite, Alabama	23
668–669	Limestone, Trenton; Alabama	23
670–671	Prairie, Alabama	24
672	Cretaceous (greensand), Alabama	22
673–680	Gneiss, Alabama	23
681–682	Prairie—Tertiary, Nebraska	53
683	Unclassified (fresh molding clay), Pennsylvania	60
684	Dead land (fine), New Mexico	55
685–686	Prairie—Tertiary, Nebraska	53
687–689	Wind-blown dust, or "black snow," Nebraska	54
690–698	Tobacco land (cigarette), Virginia	67
699–700	Unclassified, California	29
701–702	Unclassified, Mississippi	51
703–708	Alluvial soil, Ohio	58
709–712	Limestone—Knox dolomite, Tennessee	64
713–714	Lenore limestone, Tennessee	64
715–716	Cambrian—Knox shales, Tennessee	63
717–718	Limestone, St. Louis; Tennessee	64
719–720	Coal measures, Tennessee	64
721–722	Subcarboniferous, Siliceous group—Keokuk—barrens, Tennessee	65
723–724	Nashville limestone, Tennessee	64
725–726	Limestone, St. Louis; Tennessee	64
727	Unclassified (molding sand), Pennsylvania	60
728–729	Tobacco land (cigar type), Connecticut	30
730–733	Cretaceous (flatwoods), Tennessee	64
734–737	Lafayette (orange sands), Tennessee	64
738–739	Loess, Tennessee	65
740	Tobacco land (cigarette), Virginia	67
741–742	Tobacco land (cigarette), North Carolina	56
743	Tobacco land (cigarette), West Virginia	69
744–750	Tobacco land (cigarette), North Carolina	56
751	Tobacco land (cigarette), South Carolina	62
752	Tobacco land (cigarette), Louisiana	42
753	Tobacco land (cigarette), Virginia	67
754–755	Tobacco land (cigarette), North Carolina	56
756	Tobacco land (cigarette), West Virginia	69
757–763	Tobacco land (cigarette), North Carolina	56
764	Tobacco land (cigarette), South Carolina	62
765	Tobacco land (cigarette), Louisiana	42
766–775	Wheat land of the Eastern Shore, Maryland	49
776–777	Wheat land of the Eastern Shore ("white-oak land"), Maryland	49
778–779	Cambrian—Knox sandstone, Tennessee	63
780–783	Unclassified, Mississippi	51
784–788	Unclassified, Oklahoma	59
789	Tobacco land (cigarette), Virginia	67
790	Unclassified, Oklahoma	59
791–792	Prairie, Colorado	29
793	Alkali land, Colorado	29
794	Alluvial soil, Connecticut	30
795	Unclassified, Oklahoma	59
796–797	Drift, glacial, Rhode Island	60
798	Fresno Plains, California	27
799–800	Clay, brick, Maryland	44
801	Unclassified (glass sand, No. 1 grade), Maryland	49
802	Unclassified (glass sand, No. 2 grade), Maryland	49
803	Unclassified, Maryland	49
804–813	Truck land, Maryland	48
814	Tobacco land (cigarette), Virginia	67
815–818	Truck land, Maryland	48
819	Tobacco land (cigarette), Virginia	67
820–823	Unclassified, Massachusetts	50
824	Alluvial soil—black swamp muck, Alabama	22
825–829	Lafayette (orange sands), Alabama	23
830	Hammock land, Alabama	23
831	Tobacco land (cigar type), Connecticut	30
832	Lafayette (orange sands), Alabama	23
833–835	Hammock, Alabama	23
836–837	Lafayette (orange sands), Alabama	23
838–840	Post-oak flatwoods, Alabama	24
841	Lafayette (orange sands), Alabama	23
842	Tobacco land (cigar type), Connecticut	30

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
843–845	Prairie, Alabama	24
846–847	Limestone, St. Louis ("red lands"), Alabama	23
848	Unclassified, Alabama	24
849	Unclassified (pipe clay), Alabama	24
850–851	Limestone, St. Louis ("red lands"), Alabama	23
852–854	Barrens, Alabama	22
855–856	Hammock, Alabama	23
857–858	Limestone—Quebec dolomite, Alabama	23
859–860	Barrens, Alabama	22
861	Limestone, St. Louis ("red lands"), Alabama	23
862	Limestone—Knox dolomite, Alabama	23
863	Unclassified, Alabama	24
864–866	Limestone, St. Louis ("red lands"), Alabama	23
867	Tobacco land (cigar type), Massachusetts	50
868–871	Lafayette (orange sands), Alabama	23
872	Limestone—Quebec dolomite, Alabama	23
873	Limestone, St. Louis ("red lands"), Alabama	23
874	Unclassified, Alabama	24
875	Tobacco land (cigar type), Massachusetts	50
876–878	Limestone—Knox dolomite, Alabama	23
879	Limestone—Quebec dolomite, Alabama	23
880	Lafayette (orange sands), Alabama	23
881	Tobacco land (cigar type), Massachusetts	50
882–887	Lafayette (orange sands), Alabama	23
888–891	Helderberg limestone, Maryland	46
892	Oriskany, Maryland	47
893–895	Hamilton—Chemung, Maryland	45
896–900	Catskill, Maryland	44
901	Tobacco land (cigar type), Massachusetts	50
902–904	Catskill, Maryland	44
905–910	Hamilton—Chemung, Maryland	45
911	Unclassified, West Virginia	69
912–919	Hudson River shale, Maryland	46
920	Tobacco land (cigar type), Massachusetts	50
921–937	Trenton limestone, Maryland	46
938–946	Cambrian sandstone, Maryland	43
947–949	Triassic red sandstone, Maryland	47
950–958	Phillite, Maryland	47
959	Tobacco land (cigar type), Connecticut	30
960–963	Drift, glacial, Connecticut	30
964	Unclassified (timber), Oklahoma	59
965	Unclassified (blue-stem soil), Oklahoma	59
966	Limestone, California	28
967–968	Alluvial, California	27
969	Unclassified—fruit land of southern California, California	28
970–971	Unclassified, Massachusetts	50
972–975	Drift, glacial, Rhode Island	60
976–977	"Transition graywacke," Rhode Island	60
978–979	Drift, glacial, Rhode Island	60
980	Carboniferous conglomerate, Rhode Island	60
981–982	Drift, glacial, Rhode Island	60
983–986	Alluvial soil, Washington	68
987–988	Unclassified, Washington	68
989	Tobacco land (cigar type), Connecticut	30
990–992	Alluvial soil, Washington	68
993	Volcanic ash, Washington	68
994–998	Alluvial soil (rice land), North Carolina	56
999	Tobacco land (cigar type), Massachusetts	50
1000–1001	Alluvial soil (rice land), North Carolina	56
1002	Unclassified, Washington	68
1003–1004	Basalt, Washington	68
1005–1007	Alluvial soil, Washington	68
1008	Unclassified, Washington	68
1009–1010	Alluvial soil, Massachusetts	49
1011–1012	Alluvial soil, Connecticut	30
1013	Tobacco land (cigar type), Massachusetts	50
1014–1016	Triassic red sandstone, Connecticut	30
1017–1018	Limestone, Trenton and Hudson River; Kentucky	40
1019–1020	Unclassified, fruit land of southern California, California	28
1021	Alluvial soil, California	27
1022–1023	Volcanic ash, Washington	68
1024–1035	Gabbro, Maryland	45
1036–1038	Gneiss, Maryland	45
1039	Tobacco land (cigar type), Massachusetts	50
1040–1049	Gneiss, Maryland	45
1050–1051	Alluvial soil, Washington	68
1052–1053	Unclassified, Massachusetts	50
1054–1057	Alluvial soil, Massachusetts	49

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
1058	Unclassified, California	29
1059–1060	Coal measures, Kentucky	39
1061–1062	Triassic red sandstone, Connecticut	30
1063–1064	Unclassified, Connecticut	30
1065–1066	Tobacco land (cigar type), Connecticut	30
1067–1068	Triassic red sandstone, Connecticut	30
1069–1070	Drift, glacial, Connecticut	30
1071–1072	Unclassified, Connecticut	30
1073–1074	Alluvial soil, Connecticut	30
1075–1076	Unclassified, Connecticut	30
1077–1078	Unclassified, Oklahoma	59
1079–1084	Triassic red sandstone, Maryland	47
1085–1088	Trenton limestone, Maryland	46
1089–1093	Phillite, Maryland	47
1094–1095	Devonian black slate glades, Kentucky	39
1096–1097	Upper Silurian, Kentucky	40
1098–1099	Limestone, St. Louis group of Subcarboniferous ("rich barrens"), Kentucky	40
1100–1103	Limestone, Trenton and Hudson River; Kentucky	40
1104–1105	Limestone, Carboniferous, Kentucky	39
1106	Tobacco land (cigar type), Massachusetts	50
1107	Unclassified, Oklahoma	59
1108–1109	Unclassified, Massachusetts	50
1110–1114	Tobacco land (cigar type), Massachusetts	50
1115	Alluvial soil (prairie), California	27
1116	Unclassified, California	29
1117–1118	Drift, glacial, Connecticut	30
1119	Unclassified, Nevada	54
1120–1123	Chesapeake, Maryland	44
1124–1172	Wheat land of the Eastern Shore, Maryland	49
1173	Tobacco land (cigar type), Massachusetts	50
1174–1182	Wheat land of the Eastern Shore, Maryland	49
1183–1198	Truck land, Maryland	48
1199–1201	Wheat land of Eastern Shore, Maryland	49
1202–1219	Truck land, Maryland	48
1220–1221	Wheat land of Eastern Shore, Maryland	49
1222–1225	Truck land, Maryland	48
1226	Wheat land of Eastern Shore, Maryland	49
1227–1240	Truck land, Maryland	48
1241–1244	Gabbro, Maryland	45
1245–1246	Gneiss, Maryland	45
1247	Tobacco land (cigar type), Massachusetts	50
1248–1249	Gneiss, Maryland	45
1250	Tobacco land (cigar type), Massachusetts	50
1251	Gneiss, Maryland	45
1252	Tobacco land (cigar type), Connecticut	30
1253	Gneiss, Maryland	45
1254	Tobacco land (cigar type), Connecticut	30
1255–1259	Gneiss, Maryland	45
1260	Tobacco land, Trenton limestone, Pennsylvania	60
1261–1262	Unclassified, Massachusetts	50
1263–1264	Alluvial soil, Massachusetts	49
1265–1270	Unclassified, Massachusetts	50
1271–1273	Tobacco land (cigar type), Massachusetts	50
1274–1275	Unclassified, Connecticut	30
1276–1277	Tobacco land (cigar type), Connecticut	30
1278–1289	Tobacco land (cigar type), New York	56
1290–1293	Unclassified, Nevada	54
1294–1295	Waverly sandstone (Lower Subcarboniferous—"white oak land"), Kentucky	40
1296–1299	Truck land, Maryland	48
1300	Wheat land of Eastern Shore, Maryland	49
1301	Truck land, Maryland	48
1302–1305	Tobacco land (cigar type), Connecticut	30
1306	Prairie—loess, Illinois	36
1307–1308	Loess—Illinois	36
1309–1310	Prairie—loess, Illinois	36
1311–1312	Loess, Illinois	36
1313–1314	Prairie—loess, Illinois	36
1315–1318	Loess, Illinois	36
1319–1321	Prairie—loess, Illinois	36
1322	Glacial drift, Illinois	35
1323	Loess, Illinois	36
1324	Prairie—loess, Illinois	36
1325	Prairie—Galena limestone, Illinois	36
1326–1327	Glacial drift, Illinois	35
1328	Prairie—loess, Illinois	36
1329	Tobacco land (cigarette), Virginia	67
1330	Loess, Illinois	36
1331	Prairie—loess, Illinois	36

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
1332	Loess, Illinois	36
1333	Glacial drift (prairie), Illinois	35
1334	Tobacco land (cigarette), Virginia	67
1334 *a*	Glacial drift—bowlder clay, Illinois	35
1335	Glacial drift, Illinois	35
1336	Prairie—loess, Illinois	36
1337	Loess, Illinois	36
1338	Glacial drift, Illinois	35
1339	Glacial drift (prairie), Illinois	35
1340	Prairie—gumbo, Illinois	36
1341	Tobacco land (cigarette), Virginia	67
1342	Prairie—loess, Illinois	36
1343	Loess, Illinois	36
1344	Glacial drift, Illinois	35
1345	Loess, Illinois	36
1346	Glacial drift, Illinois	35
1347	Loess, Illinois	36
1348	Prairie—loess, Illinois	36
1349	Loess, Illinois	36
1350	Glacial drift, Illinois	35
1351–1357	Tobacco land (cigar type), New York	56
1358–1359	Unclassified (alluvium-prairie), Oklahoma	59
1360	Tobacco land (cigar type). Trenton limestone, Pennsylvania	60
1361	Unclassified (prairie), Oklahoma	59
1362–1363	Tobacco land (cigar type), Connecticut	30
1364	Glacial drift, Illinois	35
1365–1367	Prairie—loess, Illinois	36
1368	Loess, Illinois	36
1369	Glacial drift (prairie), Illinois	35
1370	Prairie—loess, Illinois	36
1371	Unclassified, Illinois	36
1372	Tobacco land (cigarette), Virginia	67
1373	Prairie—loess, Illinois	36
1374–1377	Subcarboniferous, Illinois	36
1378–1379	Limestone—Keokuk (Lower Subcarboniferous), Kentucky	39
1380–1381	Short-leaf-pine uplands, Mississippi	51
1382–1383	Flatwoods, Mississippi	51
1384–1387	Prairie, Mississippi	51
1388–1389	Unclassified, Mississippi	51
1390–1391	Pontotoc ridge, Mississippi	51
1392–1429	Unclassified, New York	56
1430–1431	Limestone, St. Louis group of Subcarboniferous ("rich barrens"), Kentucky	40
1432	Glacial drift—bowlder clay, Illinois	35
1433–1434	Unclassified, Nevada	54
1435–1440	Prairie—Tertiary, Nebraska	53
1441–1442	Drift, Louisiana	41
1443–1444	Alluvium, Red River, Louisiana	41
1445	Drift, Louisiana	41
1446	Lafayette (orange sands), Louisiana	41
1447–1448	Prairie, Louisiana	42
1449–1450	Cretaceous, Louisiana	41
1451–1452	Lafayette (orange sands), Louisiana	41
1453	Drift, Louisiana	41
1454–1455	Acadia clay, Louisiana	41
1456–1457	Unclassified, Louisiana	42
1458	Lafayette (orange sands), Louisiana	41
1459	Tobacco land (cigarette), Virginia	67
1460–1463	Lafayette (orange sands), Louisiana	41
1464–1465	Lafayette, District of Columbia	32
1466–1467	Prairie—Tertiary, Nebraska	53
1468–1471	Prairie—Cretaceous (Dakota group), Nebraska	53
1472–1473	Prairie—unclassified, Kansas	38
1474	Volcanic ash, Kansas	39
1475–1476	Long-leaf-pine region, Mississippi	51
1477–1478	Prairie, Mississippi	51
1479–1480	Unclassified, Mississippi	51
1481–1482	Live-oak land, Mississippi	51
1483–1487	Wheat land, Minnesota	51
1488	Glacial drift—bowlder clay, Illinois	35
1489–1490	Prairie—Tertiary, Nebraska	53
1491–1492	Prairie—Cretaceous (Colorado group), Nebraska	53
1493–1494	Wheat land, Minnesota	51
1495–1496	Lacustrine—Red River Valley, Minnesota	51
1497–1498	Tobacco land (cigar type)—limestone, Wisconsin	69
1499–1500	Alluvium, Mississippi River; Louisiana	41
1501–1504	Unclassified, Louisiana	42
1505–1508	Alluvium, Red River, Louisiana	41
1509–1524	Truck land, North Carolina	57

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
1525-1532	Pocoson region, North Carolina	56
1533-1534	Truck land, North Carolina	57
1535-1541	Unclassified, North Carolina	57
1542	Truck land, North Carolina	57
1543-1546	Unclassified, North Carolina	57
1547-1550	Truck land, North Carolina	57
1551-1560	Unclassified, North Carolina	57
1561-1566	Truck land, North Carolina	57
1567-1568	Unclassified, North Carolina	57
1569-1571	Truck land, North Carolina	57
1572-1579	Unclassified, North Carolina	57
1580-1581	Truck land, North Carolina	57
1582-1587	Unclassified, North Carolina	57
1588-1591	Truck land, Virginia	67
1592	Tobacco land (cigarette), Virginia	67
1593-1601	Truck land, Virginia	67
1602-1603	Greenhouse soil, Massachusetts	50
1604	Limestone, Trenton and Hudson River; Kentucky	40
1605	Tobacco land (cigarette), Virginia	67
1606-1608	Prairie, Kansas	38
1609	Prairie—loess, Kansas	38
1610	Prairie, Kansas	38
1611	Prairie—Dakota sandstone, Kansas	38
1612	Prairie—plains marl, Kansas	38
1613	Unclassified (molding sand), Maryland	49
1614	Tobacco land (cigarette), North Carolina	57
1615-1616	Greenhouse soil (propagating sand), District of Columbia	32
1617	Prairie—unclassified, Nebraska	54
1618	Volcanic ash, Kansas	39
1619-1620	High pine land, Florida	33
1621-1622	Etonia scrub, Florida	33
1623-1624	High pine land, Florida	33
1625-1626	Rich heavy hammock, Florida	33
1627-1632	Truck land, New Jersey	55
1633-1634	Cretaceous, New Jersey	55
1635-1636	Truck land, New Jersey	55
1637-1638	Cretaceous, New Jersey	55
1639	Tobacco land (cigarette), Virginia	67
1640	Unclassified (glass sand), Connecticut	31
1641-1650	Truck land, New Jersey	55
1651-1652	Cretaceous, New Jersey	55
1653	Tobacco land (cigarette), Virginia	67
1654	Truck land, New Jersey	55
1655-1656	Cretaceous, New Jersey	55
1657-1658	Miocene, New Jersey	55
1659-1660	Flatwoods, Florida	33
1661-1662	Truck land, New Jersey	55
1663-1669	Tobacco land (cigarette), Virginia	67
1670-1671	Prairie—loess, Nebraska	53
1672-1677	Sand Hills, Kansas	39
1678-1686	Prairie, Kansas	38
1687	Silt from irrigation ditch, Kansas	39
1688-1689	Prairie—salt-grass land, Kansas	38
1690	Prairie—gypsum soil, Kansas	38
1691-1701	Prairie, Kansas	38
1702	Limestone, Trenton and Hudson River; Kentucky	40
1703	Trenton limestone, Tennessee	64
1704-1705	Tobacco land (cigar type)—Trenton limestone, Pennsylvania	60
1706-1711	Unclassified, Virginia	68
1712-1717	Prairie—loess, Nebraska	53
1718	Trenton limestone, Tennessee	64
1719-1720	Limestone, St. Louis; Tennessee	64
1721	Shale (rye land), New York	56
1722	Tobacco land (cigarette), Virginia	67
1723-1744	Truck land, New Jersey	55
1745-1746	Cretaceous, New Jersey	55
1747-1748	Truck land, New Jersey	55
1749-1750	Miocene, New Jersey	55
1751	Tobacco land (cigarette), Virginia	67
1752-1758	Truck land, New Jersey	55
1759-1760	Cretaceous, New Jersey	55
1761-1762	Truck land, New Jersey	55
1763-1764	Cretaceous, New Jersey	55
1765-1771	Truck land, New Jersey	55
1772-1773	Cretaceous, New Jersey	55
1774	Tobacco land (cigarette), Virginia	67
1775	Prairie—blue-stem soil, Kansas	38
1776	Prairie—plains marl, Kansas	38

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
1777	Prairie, Kansas	38
1778	Prairie—alkali, Kansas	37
1779-1780	Sedentary soil, Kansas	39
1781-1782	Prairie—plains marl, Kansas	38
1783	Prairie—plains marl, Colorado	30
1784	Prairie—plains marl, Kansas	38
1785	Prairie, Colorado	30
1786	Prairie—plains marl, Kansas	38
1787-1788	Alluvial soil—cranberry bog, New Jersey	54
1789	Prairie—plains marl, Kansas	38
1790-1791	Sedentary soil, Kansas	39
1792	Volcanic ash, Kansas	39
1793	Prairie—magnesia soil, Kansas	38
1794-1795	Prairie—plains marl, Nebraska	53
1796	Prairie, Nebraska	53
1797-1801	Prairie—plains marl, Nebraska	53
1802	Prairie, Nebraska	53
1803-1804	Prairie—plains marl, Nebraska	53
1805-1806	Prairie—magnesia soil, Nebraska	53
1807	Prairie, Nebraska	53
1808-1809	Prairie—plains marl, Nebraska	53
1810-1832	Prairie, Nebraska	54
1833	Tobacco land (cigarette), Virginia	67
1834-1843	Prairie, Nebraska	54
1844-1845	Prairie—plains marl, Colorado	30
1846	Prairie, Colorado	30
1847	Greenhouse soil, Connecticut	30
1848-1853	Limestone, Trenton and Hudson River; Kentucky	40
1854-1855	Prairie, Nebraska	54
1856-1857	Prairie (wheat land), South Dakota	63
1858-1863	Prairie—lacustrine, alluvial soil (Red River Valley), North Dakota	58
1864-1869	Prairie—loess, Nebraska	53
1870	Prairie, Colorado	29
1871-1876	Trenton limestone, Tennessee	64
1877	Prairie, Kansas	38
1878-1881	Limestone, St. Louis group, Tennessee	64
1882-1884	Prairie, Kansas	38
1885	Prairie—gypsum soil, Kansas	38
1886-1889	Prairie, Kansas	38
1890-1897	Tobacco land (cigarette), Virginia	67
1898	Unclassified, Virginia	68
1899	Gneiss, North Carolina	56
1900-1901	Unclassified, North Carolina	57
1902	Tobacco land (cigarette), North Carolina	57
1903	Unclassified, North Carolina	57
1904	Tobacco land (cigarette), North Carolina	57
1905	Tobacco land (cigarette) (pipe clay), North Carolina	57
1906-1913	Tobacco land (cigarette), North Carolina	57
1914	Unclassified, North Carolina	57
1915-1916	Prairie, Nebraska	54
1917-1918	Unclassified, Pennsylvania	60
1919-1920	Tobacco land (cigar type)—Trenton limestone, Pennsylvania	60
1921-1922	Drift, Alabama	22
1923-1926	Cretaceous, Alabama	22
1927	Limestone, Trenton and Hudson River; Kentucky	40
1928	Gabbro, Maryland	45
1929-1930	Trenton limestone, Tennessee	64
1931	Cambrian—Knox sandstone (cigarette tobacco), Tennessee	63
1932	Limestone, St. Louis; Tennessee	64
1933	Limestone, Trenton and Hudson River; Kentucky	40
1934-1935	Tobacco land (cigar type), Massachusetts	50
1936	Tobacco land (cigar type), New York	56
1937-1939	Tobacco land (cigar type), Connecticut	30
1940-1941	Prairie—gumbo, Kansas	38
1942-1952	Muck land, Florida	34
1953-1954	Gray hammock, Florida	33
1955	Unclassified, Florida	34
1956	Gray hammock, Florida	33
1957	Wind-blown dust or "black snow," Indiana	37
1958-1961	Tobacco land (cigar type), Cuba	31
1962-1963	Prairie—gumbo, Kansas	38
1964-1966	Tobacco land (cigar type), Cuba	31
1967	Clay, pottery (china clay), New Jersey	54
1968	Clay, pottery (china clay), Delaware	31
1969	Clay, pottery (glass pots and fire brick), Missouri	52
1970	Clay, pottery, Ohio	58
1971	Clay, pottery (Albany slip clay), New York	55
1972	Clay, pottery (crude ball clay), Kentucky	39

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
1973	Clay, pottery (ground feldspar), Pennsylvania	59
1974	Clay, pottery (ground Cornwall stone), England	32
1975	Clay, pottery (china clay), Delaware	31
1976	Clay, pottery (kaolin), Florida	32
1977–1978	Clay, pottery (stoneware clay), Ohio	58
1979	Clay, pottery (crude kaolin), Ohio	58
1980	Clay, pottery (washed kaolin), Ohio	58
1981	Unclassified, North Carolina	57
1982	Tobacco land (cigar type), Cuba	31
1983	Greenhouse soil, Ohio	58
1984–1988	Wheat land of Eastern Shore, Maryland	49
1989	Truck land, Maryland	48
1990–1991	Limestone, Trenton and Hudson River; Kentucky	40
1992–1994	High pine land, Florida	33
1995	Wind-blown dust or "black snow," Indiana	37
1996	Unclassified, North Carolina	57
1997	Tobacco land (manufacturing and export), Virginia	67
1998–2008	Limestone, Trenton, Virginia	66
2009–2014	Truck land, Virginia	67
2015	Truck land, Maryland	48
2016–2025	Tobacco land (sun cured), Virginia	67
2026–2032	Tobacco land (cigarette), Virginia	67
2033–2040	Limestone, Trenton, Virginia	66
2041–2056	Tobacco land (cigarette), Virginia	67
2057–2058	Limestone, Trenton, Virginia	66
2059–2069	Tobacco land (manufacturing and export), Virginia	67
2070–2073	Prairie—Carboniferous, Nebraska	53
2074–2075	Prairie—Cretaceous (Dakota group), Nebraska	53
2076–2085	Prairie—Tertiary, Nebraska	53
2086–2087	Prairie—Cretaceous (Dakota group), Nebraska	53
2088–2091	Prairie—Tertiary, Nebraska	53
2092–2093	Prairie—Cretaceous (Colorado group), Nebraska	53
2094–2095	Prairie—Tertiary, Nebraska	53
2096–2097	Prairie—Cretaceous (Colorado group), Nebraska	53
2098–2103	Prairie—Tertiary, Nebraska	53
2104–2105	Prairie—Cretaceous (Colorado group), Nebraska	53
2106–2107	Prairie—Tertiary, Nebraska	53
2108–2109	Prairie—Cretaceous (Colorado group), Nebraska	53
2110–2111	Prairie—Tertiary, Nebraska	53
2112–2113	Prairie—Cretaceous (Colorado group), Nebraska	53
2114–2117	Prairie—Tertiary, Nebraska	53
2118–2120	Truck land, Maryland	48
2121–2124	Tobacco land (cigarette), Virginia	67
2125–2126	Tobacco land (sun cured), Virginia	67
2127	Barrens (pipe clay), Virginia	66
2128–2129	Tobacco land (sun cured), Virginia	67
2130	Barrens (pipe clay), Virginia	66
2131–2133	Barrens (crayfish land), Virginia	66
2134–2142	Barrens (pipe clay), Virginia	66
2143	Black waxy soil—Cretaceous ("Eagle Ford clay"), Texas	65
2144–2162	Chesapeake, Maryland	44
2163–2164	Prairie, Nebraska	54
2165–2168	Prairie, Texas	65
2169	Unclassified, Maryland	49
2170–2181	Catskill, Maryland	44
2182–2183	Unclassified, Virginia	68
2184	Clay, pottery, Maryland	44
2185–2186	Clay, brick and tile, District of Columbia	32
2187–2190	Truck land, Maryland	48
2191–2194	Unclassified, North Carolina	57
2195–2202	Tobacco land, Sumatra	63
2203–2206	Unclassified, North Carolina	57
2207–2210	Tobacco land, Sumatra	63
2211	Greenhouse soil, Pennyslvania	59
2212–2214	Pineapple land, Florida	34
2215–2225	Greenhouse soil, Pennsylvania	59
2226–2228	Greenhouse soil, New York	55
2229	Greenhouse soil, Vermont	66
2230	Greenhouse soil, Pennsylvania	59
2231	Greenhouse soil, Illinois	36
2232	Greenhouse soil, Indiana	36
2233	Greenhouse soil, Michigan	50
2234	Greenhouse soil, Maryland	45
2235–2236	Clay, pottery and brick, Maryland	44
2237	Greenhouse soil, New Jersey	55
2238	Greenhouse soil, North Carolina	56
2239	Greenhouse soil, New York	55
2240	Greenhouse soil, Minnesota	51

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of samples.	Classification.	Page in this bulletin.
2241-2242	Greenhouse soil, Massachusetts	50
2243	Greenhouse soil, Michigan	50
2244-2245	Alluvial soil, Texas	65
2246	Greenhouse soil, Indiana	36
2247	Greenhouse soil, Michigan	50
2248	Greenhouse soil, New Jersey	55
2249	Greenhouse soil, Maryland	45
2250	Greenhouse soil, California	28
2251-2252	Greenhouse soil, Pennsylvania	59
2253-2255	Greenhouse soil, New York	55
2256	Greenhouse soil, Massachusetts	50
2257	Greenhouse soil, Michigan	50
2258	Greenhouse soil, Massachusetts	50
2259-2260	Greenhouse soil, New York	55
2261	Greenhouse soil, California	28
2262-2263	Tobacco land (cigar type), California	28
2264-2275	Greenhouse soil, New York	55
2276	Greenhouse soil, New Jersey	55
2277-2278	Greenhouse soil, Massachusetts	50
2279-2280	Unclassified, Washington	68
2281-2286	Tobacco land (cigar type), Texas	65
2287-2288	Drift, glacial, Minnesota	51
2289-2295	Lacustrine (Red River Valley) prairie, Minnesota	51
2296-2297	Alluvial soil (Tamerse River) prairie, Minnesota	51
2298	Lacustrine (Red River Valley) prairie, Minnesota	51
2299-2300	Lacustrine (Red River Valley) gumbo, Minnesota	51
2301-2302	Alkali land, Minnesota	51
2303-2305	Phillite, Maryland	47
2306	Gneiss, Maryland	45
2307-2313	Chernozem (black earth), Russia	61
2314	Greenhouse soil, Pennsylvania	59
2315	Unclassified, Georgia	34
2316-2322	Truck land, North Carolina	57
2323-2324	Truck land, Illinois	36
2325-2326	Unclassified, Illinois	36
2327-2328	Truck land, Illinois	36
2329-2330	Gumbo, Iowa	37
2331	Unclassified, Iowa	37
2332-2333	Gumbo, Iowa	37
2334	Unclassified, Iowa	37
2335-2336	Gumbo, Iowa	37
2337	Unclassified, Iowa	37
2338	Gumbo, Iowa	37
2339	Loess, Iowa	37
2340	Tobacco land (manufacturing and export)—gneiss, Virginia	67
2341-2346	Long-leaf-pine hills, Louisiana	41
2347-2348	Long-leaf-pine hills (hogwallow land), Louisiana	41
2349-2356	Long-leaf-pine hills, Louisiana	41
2357-2360	Alluvium (Red River Valley), Louisiana	41
2361	Long-leaf-pine hills, Louisiana	41
2362-2363	Unclassified, Louisiana	42
2364	Long-leaf-pine hills, Louisiana	41
2365-2366	Prairie, pine, Louisiana	42
2367-2370	Prairie Marmou, Louisiana	42
2371-2372	Unclassified, Louisiana	42
2373-2376	Prairie, Plaquemine, Louisiana	42
2377-2380	Prairie, Louisiana	42
2381-2386	Prairie, Calcasieu, Louisiana	42
2387-2390	Prairie Swallow, Louisiana	42
2391-2392	Prairie Marmou, Louisiana	42
2393-2394	Prairie, Faquataique, Louisiana	42
2395-2396	Prairie, Plaquemine, Louisiana	42
2397-2421	Bluff land, Louisiana	41
2422-2425	Alluvium, Mississippi River, Louisiana	41
2426-2427	Prairie, Louisiana	42
2428	Prairie, black ("buckshot land"), Louisiana	42
2429-2435	Prairie, Louisiana	42
2436	Long-leaf-pine hills, Louisiana	41
2437-2438	Hammock, Louisiana	41
2439-2442	Long-leaf-pine flats, Louisiana	41
2443-2444	Unclassified, Louisiana	42
2445-2446	Long-leaf-pine hills, Louisiana	41
2447-2448	Prairie, Louisiana	42
2449-2450	Prairie Swallow, Louisiana	42
2451-2452	Prairie Marmou, Louisiana	42
2453-2454	Prairie, black ("buckshot land"), Louisiana	42
2455-2462	Prairie, Louisiana	42
2463-2464	Prairie, black ("buckshot land"), Louisiana	42
2465-2466	Bluff land, Louisiana	41

List of soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
2467-2468	Prairie, black ("buckshot land"), Louisiana	42
2469-2474	Bluff land, Louisiana	41
2475	Prairie, black ("buckshot land"), Louisiana	42
2476-2481	Prairie, Louisiana	42
2482-2484	Unclassified, Louisiana	42
2485	Prairie, Louisiana	42
2486	Bluff land, Louisiana	41
2487	Alluvium, Mississippi River, Louisiana	41
2488-2489	Unclassified. Louisiana	42
2490-2493	Alluvium, Mississippi River, Louisiana	41
2494	Bluff land, Louisiana	41
2495-2499	Prairie, black ("buckshot land"), Louisiana	42
2500	Bluff land, Louisiana	41
2501	Prairie, black ("buckshot land"), Louisiana	42
2502	Prairie, Louisiana	42
2503-2506	Alluvium, Red River, Louisiana	41
2507-2510	Tobacco land (cigar type)—Trenton limestone, Pennsylvania	60
2511-2512	Tobacco land (cigar type)—phillite, Pennsylvania	60
2513-2516	Tobacco land (cigar type)—shaly limestone, Pennsylvania	60
2517-2518	Bluff land, Louisiana	41
2519-2520	Bluff land (crayfish), Louisiana	41
2521-2522	Long leaf-pine flats, Louisiana	41
2523-2525	Long leaf-pine hills, Louisiana	41
2526	Bluff land, Louisiana	41
2527-2528	Long-leaf-pine hills, Louisiana	41
2529-2541	Alluvium, Red River, Louisiana	41
2542	Loess, Iowa	37
2543-2548	Wheat land of Eastern Shore, Maryland	49
2549-2550	Truck land, Maryland	48
2551-2554	Wheat land of Eastern Shore, Maryland	49
2555-2557	Wheat land of Eastern Shore ("white-oak land"), Maryland	49
2558-2559	Wheat land of Eastern Shore, Maryland	49
2560-2562	Wheat land of Eastern Shore ("white-oak land"), Maryland	49
2563-2564	Wheat land of Eastern Shore, Maryland	49
2565-2566	Black waxy soil—Cretaceous, Texas	65
2567-2568	Tobacco land (cigar type)—shaly limestone, Pennsylvania	60
2569-2570	Tobacco land (cigar type)—Trenton limestone, Pennsylvania	60
2571	Potsdam sandstone, Pennsylvania	60
2572	Tobacco land (cigar type)—shaly limestone, Pennsylvania	60
2573-2574	Tobacco land (cigar type)—river land, Pennsylvania	60
2575-2578	Unclassified, Pennsylvania	60
2579-2589	Limestone, Trenton and Hudson River; Kentucky	40
2590-2647	Limestone, St. Louis; Tennessee	64
2648-2649	Potomac, Maryland	47
2650-2653	Truck land, Maryland	48
2654-2657	Potomac, Maryland	47
2658	Truck land, Maryland	48
2659	Columbia, Lower—river terrace, Maryland	45
2660-2663	Potomac, Maryland	47
2664-2670	Truck land, New Jersey	55
2671-2672	Alluvial soil, cedar swamp, New Jersey	54
2673-2680	Truck land, New Jersey	55
2681-2682	Lafayette, pine barrens, Maryland	46
2683-2684	Potomac, District of Columbia	32
2685-2686	Lafayette District of Columbia	32
2687-2688	Potomac, District of Columbia	32
2689-2690	Chesapeake, District of Columbia	32
2691-2692	Eocene, District of Columbia	32
2693-2694	Truck land, Eocene, Maryland	48
2695-2696	Columbia, District of Columbia	32
2697	Silt terrace of Nueces River, Texas	65
2698	Alluvial soil, Texas	65
2699	Basalt, Texas	65
2700	Silt terrace of Nueces River, Texas	65
2701-2702	Eocene, District of Columbia	32
2703-2704	Columbia, District of Columbia	32
2705-2707	Potomac, Maryland	47
2708	Potomac, District of Columbia	32
2709-2716	Lafayette, District of Columbia	32
2717-2718	Lafayette—pine barrens, Maryland	46
2719-2721	Drift, glacial, Connecticut	30
2722-2724	Alluvial soil—peat swamp, Connecticut	30
2725	Phillite, Maryland	47
2726	Loess, China	29
2727-2742	Trenton limestone, Maryland	46
2743-2744	Cambrian sandstone, Maryland	43
2745-2761	Trenton limestone, Maryland	46
2762-2769	Hudson River shale, Maryland	46

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
2770-2783	Trenton limestone, Maryland	46
2784-2785	Hudson River shale, Maryland	46
2786-2792	Trenton limestone, Maryland	46
2793	Greenhouse soil, Pennsylvania	59
2794-2795	Chesapeake, Maryland	44
2796-2802	Unclassified, Maryland	49
2803	Red Hill formation, South Carolina	62
2804	Tobacco land (cigar type)—Trenton limestone, Pennsylvania	60
2805	Limestone, Trenton; Virginia	66
2806	Truck land, Maryland	48
2807	Sea Island cotton and truck soil, South Carolina	62
2808	Prairie—loess, Illinois	36
2809	Prairie—plains marl, Nebraska	53
2810-2811	Adobe (diabasic), Oregon	59
2812-2813	Muck land, Florida	34
2814-2816	Greenhouse soil, New Jersey	55
2817-2821	Gray hammock, Florida	33
2822-2823	Mulatto hammock, Florida	33
2824-2826	High pine land, Florida	33
2827-2831	Light hammock, Florida	33
2832-2836	Rich heavy hammock, Florida	33
2837-2846	Mixed land, Florida	34
2847-2848	Light hammock, Florida	33
2849	Unclassified, Florida	34
2850-2855	High pine land, Florida	33
2856	Lafayette, Florida	34
2857-2860	Gray hammock, Florida	33
2861-2864	Red coquina hammock, Florida	33
2865-2868	Spruce-pine scrub, Florida	34
2869-2870	High pine land, Florida	33
2871-2874	Light hammock, Florida	33
2875-2880	High pine land, Florida	33
2881-2885	Rich heavy hammock, Florida	33
2886-2891	Pineapple land, Florida	34
2892-2893	Muck land, Florida	34
2894-2902	Lafayette, Florida	34
2903-2905	Fuller's earth, Florida	33
2906-2909	High pine land, Florida	33
2910	Lafayette, Florida	34
2911-2912	High pine land, Florida	33
2913-2919	Etonia scrub, Florida	33
2920	High pine land, Florida	33
2921	Basalt, Washington	68
2922-2931	Tobacco, Perique, Louisiana	42
2932-2934	Muck land, Florida	34
2935-2936	Gray hammock, Florida	33
2937-2938	Unclassified, Florida	34
2939-2940	High pine land, Florida	33
2941-2942	Spruce-pine scrub, Florida	34
2943-2944	Unclassified, Tennessee	65
2945-2946	Black waxy soil—Cretaceous, Texas	65
2947-2948	Gray hammock, Florida	33
2949-2950	Tobacco land (cigarette), North Carolina	57
2951-2952	Carboniferous sandstone, West Virginia	68
2953-2955	Unclassified, West Virginia	69
2956-2960	Limestone, Trenton and Hudson River; Kentucky	40
2961-2964	Alluvial soil, Kentucky	39
2965-2967	Unclassified, Ohio	59
2968-2987	Gabbro, Maryland	45
2988-2990	Gneiss, Maryland	45
2991	Gabbro, Maryland	45
2992-3015	Gneiss, Maryland	45
3016-3029	Phillite, Maryland	47
3030-3037	Serpentine, Maryland	47
3038-3051	Phillite, Maryland	47
3052-3053	Gneiss, Maryland	45
3054-3058	Unclassified, Maryland	49
3059-3062	Phillite, Maryland	47
3063	Triassic red sandstone, Maryland	47
3064-3065	Unclassified, Bermuda	25
3066-3080	Limestone, Trenton and Hudson River; Kentucky	40
3081-3091	Hudson River limestone, Ohio	59
3092-3097	Alluvial soil, Ohio	58
3098-3100	Glacial drift (cigar tobacco), Ohio	58
3101-3103	Alluvial soil, Ohio	58
3104-3105	Glacial drift (cigar tobacco), Ohio	58
3106-3107	Alluvial soil, Ohio	58
3108-3121	Glacial drift (cigar tobacco), Ohio	58

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample.	Classification.	Page in this bulletin.
3122-3145	Limestone, St. Louis group of Subcarboniferous ("rich barrens"), Kentucky	40
3146-3157	Subcarboniferous, Tennessee	65
3158-3183	Limestone, St. Louis group of Subcarboniferous ("rich barrens"), Kentucky	40
3184-3189	Lafayette (orange sands), Tennessee	64
3190-3201	Post-Tertiary, Kentucky	40
3202-3203	Alluvial soil, Kentucky	39
3204-3209	Post-Tertiary, Kentucky	40
3210-3211	Alluvial soil, Kentucky	39
3212-3219	Post-Tertiary, Kentucky	40
3220-3237	Limestone, Carboniferous, Kentucky	39
3238	Fuller's earth, England	32
3239	Fuller's earth, Nebraska	52
3240	Silt, Arizona	25
3241	Kaolinite, Colorado	29
3242-3243	Prairie, Nebraska	54
3244-3259	Tobacco land (cigar type), Wisconsin	69
3260-3270	Prairie—Jamestown Valley, North Dakota	58
3271-3273	Prairie—lacustrine, alluvial soil (Red River Valley), North Dakota	58
3274-3277	Prairie (wheat land), North Dakota	58
3278-3283	Prairie—lacustrine, alluvial soil (Red River Valley), North Dakota	58
3284-3292	Prairie (wheat land), North Dakota	58
3293-3294	Alkali land, North Dakota	57
3295	Prairie (wheat land), North Dakota	58
3296	Alkali land (hardpan), North Dakota	57
3297-3302	Prairie (wheat land), North Dakota	58
3303-3304	Basalt, Idaho	35
3305-3306	Prairie—alkali land, Montana	52
3307-3323	Prairie, Montana	52
3324-3325	Basalt, Washington	68
3326-3328	Volcanic ash, Washington	68
3329	Unclassified, Washington	68
3330-3338	Basalt, Washington	68
3339-3341	Alkali land, Washington	68
3342-3355	Basalt, Washington	68
3356	Unclassified, Washington	68
3357-3364	Prairie—alkali land, Montana	52
3365-3376	Prairie, Montana	52
3377-3382	Tulare Plains (alkali), California	28
3383-3384	Mojave Desert (alkali hardpan), California	28
3385-3386	Mojave Desert (alkali), California	28
3387-3390	Mojave Desert, California	28
3391	Fresno Plains, California	28
3392	Fresno Plains (hogwallow), California	28
3393-3396	Fresno Plains, California	28
3397-3399	Fresno Plains (alkali), California	28
3400	Fresno Plains, California	28
3401-3403	Unclassified—fruit land of Southern California, California	28
3404	Adobe, California	27
3405	Unclassified—fruit land of southern California, California	28
3406-3407	Alkali land, California	27
3408-3409	Alluvial soil, California	27
3410-3417	Tulare Plains, California	28
3418-3423	Alkali land, Nevada	54
3424-3425	Prairie, Colorado	30
3426	Bench land, Utah	66
3427-3428	Valley land, Utah	66
3429	Bench land, Utah	66
3430-3437	Unclassfied—fruit land of southern California, California	28
3438-3466	Unclassified, Alaska	24
3467-3474	Devonian black slate (glades), Kentucky	39
3475-3476	Prairie, Colorado	30
3477-3479	Unclassified, Bermuda	25
3480-3481	Medina sandstone, Maryland	47
3482-3485	Clinton-Niagara, Maryland	44
3486	Alluvial soil, Maryland	43
3487-3488	Clinton-Niagara, Maryland	44
3489-3495	Helderberg limestone, Maryland	46
3496-3501	Oriskany, Maryland	46
3502-3520	Hamilton-Chemung, Maryland	45
3521-3535	Catskill, Maryland	44
3536-3540	Subcarboniferous—Pocono sandstone, Maryland	47
3541-3546	Subcarboniferous—Greenbrier, Maryland	47
3547-3549	Subcarboniferous, Maryland	47
3550-3556	Pottsville, Maryland	47
3557-3565	Lower coal measures—Savage, Maryland	46
3566-3575	Lower coal measures—Bayard, Maryland	46
3576-3584	Lower coal measures—Fairfax, Maryland	46
3585-3591	Upper coal measures, Maryland	49

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of sample	Classification.	Page in this bulletin.
3592-3593	Unclassified, Maryland	49
3594-3597	Alluvial soil, Maryland	43
3598-3607	Truck land, Alabama	24
3608-3609	Limestone, St. Louis ("red lands"), Alabama	23
3610	Subcarboniferous, Tennessee	65
3611-3622	Volcanic ash, Hawaiian Islands	35
3623-3628	Gray hammock, Florida	33
3629-3630	High pine land, Florida	33
3631	Gray hammock, Florida	33
3632	Flatwoods (alkali), Florida	33
3633	Gray hammock, Florida	33
3634-3639	Unclassified (tobacco and coffee), Mexico	50
3640	Diabase, Virginia	66
3641	Unclassified, District of Columbia	32
3642	Potomac, District of Columbia	32
3643-3656	Unclassified, Alaska	24
3657-3681	Wheat land, Argentina	25
3682	Unclassified, Idaho	35
3683-3686	Prairie, Nebraska	54
3687-3692	Gray hammock, Florida	33
3693-3694	High pine land, Florida	33
3695	Unclassified, Maryland	49
3696	Unclassified, Alaska	24
3697	Alkali land, Russia	61
3698-3699	Permian (wheat land), Texas	65
3700-3701	Medina sandstone, Maryland	47
3702-3706	Clinton-Niagara, Maryland	44
3707-3709	Helderberg limestone, Maryland	46
3710	Oriskany, Maryland	47
3711-3713	Hamilton-Chemung, Maryland	45
3714-3722	Catskill, Maryland	44
3723	Subcarboniferous, Maryland	47
3724	Pottsville, Maryland	47
3725	Lower coal measures—Savage, Maryland	46
3726-3729	Lower coal measures—Bayard, Maryland	46
3730-3731	Lower coal measures—Fairfax, Maryland	46
3732-3733	Glacial drift, Ohio	58
3734-3736	Unclassified, Colorado	30
3737-3738	Prairie—loess, Kansas	38
3739-3742	Prairie—loess, Nebraska	53
3743-3747	Prairie (wheat land), North Dakota	58
3748	Bad land, North Dakota	58
3749-3751	Alkali (bad land), North Dakota	57
3752	Bad land, North Dakota	58
3753	Prairie—lacustrine, alluvial soil (Red River Valley), North Dakota	58
3754	Pierre shale, Montana	52
3755-3756	Fox Hill sandstone, Montana	52
3757	Pierre shale, Montana	52
3758	Prairie—alkali land (gumbo), Montana	52
3759-3785	Prairie, Montana	52
3786-3788	Columbia, Lower—river terrace, Maryland	45
3789-3790	Eocene marl, Maryland	47
3791	Columbia, District of Columbia	32
3792-3793	Columbia, Lower—river terrace, Maryland	45
3794-3797	Lafayette, pine barrens, Maryland	46
3798-3801	Columbia, Lower—river terrace, Maryland	45
3802-5804	Lafayette—pine barrens, Maryland	46
3805-3806	Chesapeake, Maryland	44
3807-3808	Lafayette—pine barrens, Maryland	46
3809-3810	Chesapeake, Maryland	44
3811-3814	Truck land, Maryland	48
3815-3816	Columbia, Lower—river terrace, Maryland	45
3817-3818	Gneiss, Maryland	45
3819-3824	Unclassified, Texas	66
3825-3826	Alluvial soil—Dismal Swamp land, Virginia	66
3827-3828	Truck land, Virginia	67
3829-3840	Alluvial soil—Dismal Swamp land, Virginia	66
3841-3842	Unclassified, North Carolina	57
3843-3858	Lake Erie bottom, Ohio	58
3859-3861	Unclassified, Virginia	68
3862-3863	Unclassified, Maryland	49
3864-3872	Prairie (wheat land), South Dakota	63
3873	Serpentine, Maryland	47
3874-3880	Vineyard soil, Germany	35
3881-3887	Hudson River shale, Maryland	46
3888-3889	Trenton limestone, Maryland	46
3890-3895	Cambrian sandstone, Maryland	43
3896-3897	Catoctin granite, Maryland	44
3898-3901	Catoctin schist, Maryland	44

List of the soil samples, arranged serially from 1 to 4000—Continued.

No. of samples.	Classification.	Page in this bulletin.
3902-3906	Catoctin granite, Maryland	44
3907-3908	Catoctin schist, Maryland	44
3909-3913	Catoctin granite, Maryland	44
3914	Trenton limestone, Maryland	46
3915-3916	Cambrian sandstone, Maryland	43
3917-3918	Trenton limestone, Maryland	46
3919-3920	Alkali land, Mississippi	51
3921-3934	Alluvial soil—Dismal Swamp land, Virginia	66
3935-3955	Unclassified, North Carolina	57
3956	Basalt, Washington	68
3957	Triassic red sandstone, Maryland	47
3958	Gneiss, Maryland	45
3959	Tobacco land (manufacturing and export)—gneiss, Virginia	67
3960	Tobacco land (cigarette), North Carolina	56
3961	Alluvial soil, South Carolina	61
3962	Alluvium, Mississippi River, Louisiana	41
3963	Alkali land, Nevada	54
3964	Prairie—lacustrine, alluvial soil (Red River Valley), North Dakota	58
3965	Pineapple land, Florida	34
3966	Prairie, Illinois	36
3967-3974	Fuller's earth (crude), Florida	33
3975	Unclassified (irrigation hardpan), California	29
3976	Unclassified (coral sand), Bermuda	25
3977	Unclassified, Bermuda	25
3978	Prairie (zinc clay, sulphide), Kansas	38
3979	Volcanic ash, Nebraska	54
3980-3981	Unclassified, California	29
3982-3985	Tobacco land (cigarette), North Carolina	57
3986-3992	Unclassified, North Carolina	57
3993	Gneiss, Maryland	45
3994	Limestone, St. Louis group of Subcarboniferous ("rich barrens"), Kentucky	40
3995-3999	Unclassified, Bermuda	25
4000	Alluvial soil, Michigan	50

LIST OF THE FORMATIONS REPRESENTED IN THE COLLECTION OF SOILS.

The following alphabetical list of the formations represented in the collection of the Division shows the States or countries from which samples have been obtained and the number of samples from each locality, with references to the pages of this bulletin in which data regarding these samples are to be found. A brief description is given of the formations in which any peculiar properties or relations are pointed out, and the basis for the classification is shown:

ACADIA CLAY.

Locality:

	Page.
Louisiana, 2 samples	41

Description.—The basis of this classification is geological, and apart from this the group is of no general interest.

ADOBE.

Localities:

	Page.
California, 6 samples	27
New Mexico, 1 sample	55
Oregon, 2 samples	59
Total, 9 samples.	

Description.—Agriculturally, the term adobe relates to a condition of the soil often seen in the West. Geologically, the term is frequently applied to certain areas in the West which closely resemble loess. Such a description by I. C. Russell, from the standpoint of a geologist, is given under the loess group.

The soils classed agriculturally as adobe vary considerably in texture and in chemical composition. Different types are recognized as sandy adobe, ridge adobe, brown adobe, black adobe, and black-waxy adobe. As a rule adobe soils act as stiff clay lands, rather heavy in texture and extremely productive. The soil is usually quite sticky when wet, but is easily cultivated when in the right condition. The heaviest adobe is, however, difficult to till, as plows do not scour well, and need to be repeatedly cleaned. When plowed too wet the adobe is liable to break up in lumps, but these are easily pulverized on drying. When subjected to superficial cultivation the adobe is liable to contract greatly in drying, leaving great cracks going down into the subsoil. When thoroughly cultivated it forms in dry weather an almost ash-like dust mulch.

The following references to adobe, by Prof. E. W. Hilgard,[1] bring out very clearly the marked and peculiar character of adobe as the term is used in agriculture:

Black adobe.—The black soil here [on the agricultural grounds at Berkeley] is over 30 inches deep, underlaid by a yellow, stony subsoil. It becomes exceedingly "sticky" when wet, but plows easily when taken just at the right point of moisture; when plowed a little too wet, clots heavily, but the clots tend to pulverize in drying. With shallow tillage, or when left untilled, it forms widely gaping cracks in the dry season. If tilled deeply and thoroughly, it retains moisture and a luxuriant growth of weeds throughout the dry season, and is almost ashy in its tilth. * * *

Adobe, ridge.—Tint, a tawny yellow. Very heavy in working; difficult to till at all times; downward it gradually passes into "rotten" clay sandstone at a depth varying from 2½ to 5 feet. It is, therefore, ill-drained naturally, holds water for a long time, and is esteemed rather a poor soil. * * * To one familiar with the prairie soils of the southwestern United States, the resemblance of the "black adobe" of California to the "black prairie" of Mississippi and Alabama is very striking. The analyses abundantly confirm this supposition. Both the mechanical and chemical composition of the adobe is so nearly like that of the "white-lime prairie" soil of Monroe County, Miss., that the differences are scarcely greater than might be found in different localities in either region. * * * There is one difference in favor of California adobe—it is about one-third richer in phosphates than the "prairie," and this explains the fact that grain crops, so exhaustive of that ingredient, have for a succession of eighteen to twenty years been grown without apparent diminution.

The fact that the black adobe contains 1 per cent of lime shows that the addition of any small amount of lime, as a manure, would be useless—a conclusion directly confirmed by the culture experiments. But it is nevertheless true that the tillability of the soil may be greatly improved by such addition of lime as can be afforded in cultivation on a large scale, as in truck gardens, orchards, flower gar-

[1] Report on agricultural experiment stations of the University of California, with descriptions of the regions represented, pages 28–30.

dens, lawns, etc. * * * The differences in the mechanical and chemical composition of the ridge adobe from that of the valley is sufficiently striking. It contains less than two-thirds the amount of clay, yet it is much heavier in working, owing to the small quantities of the finer sediments, which chiefly serve to break up the extreme tenacity of pure clay, that is but little disturbed by the large-sized grains. Then the soil contains less than half as much lime as the lowland adobe; less than half, also, of the primarily important ingredients, potash and phosphoric acid; and, finally, very much less humus, as is shown by its tint. * * * Of course, the soils vary in accordance with the rocks from which they have been formed. Those derived from the Tertiary clays and soft clay stones are predominantly "adobe" or heavy clay soils, mostly brown or blackish, and very commonly overlie the very rocks from which they are derived ("colluvial" and "sedentary"). They are found on the higher lands rather than in valleys, and usually appear on the "divides" and ridge lands generally, as well as in the higher valleys.

ALKALI SOIL.

Localities:

Description.—The term "alkali soil" is applied generally to any soil containing an excessive amount of mineral salts or alkalies proper, especially sodium, potassium, and magnesium chlorides, sulphates and carbonates, and occasionally nitrates and borates. They are confined to arid districts where the rainfall does not exceed 10 or 15 inches per annum, but are widely distributed within these areas. Injudicious methods of irrigation, especially in the use of too much water without adequate underdrainage and the consequent accumulation of seepage waters and seepage from canals frequently cause a rise of alkali and a local accumulation at the surface. Of the three most important and widespread salts, sodium carbonate is the most destructive to vegetation; sodium chloride comes next; and lastly sodium sulphate. Hilgard states that few plants can stand as much as 0.1 per cent of sodium carbonate, 0.25 per cent of sodium chloride, and 0.45 to 0.50 per cent of sodium sulphate. Plants can stand more alkali on heavy than on light soils.

Frequent cultivation and care in applying water to the land and prevention of seepage from canals are the best preventives against the rise or accumulation of alkali. A correction for sodium carbonate is heavy applications of gypsum to the soil. The only remedy for a large excess of the chlorides or the sulphates is thorough underdrainage. An idea

of the general distribution of these salts may be inferred from the following statement. In the Dakotas and Montana, the prevailing salts are sodium and magnesium sulphates; in Washington and Oregon, sodium carbonate and sodium and magnesium sulphates; in southern California, all of the above salts and sodium chloride characterize certain districts; in Arizona and New Mexico, the prevailing salts are sodium and magnesium sulphates; in Utah, sodium chloride covers the largest area; in Nevada, sodium chloride covers a very large area, but the other salts predominate in certain districts, and at least one large area is covered with borates.

All kinds of soil are liable to contain alkali, but soils of light texture, being generally better drained, are easier to treat than heavy soils. The catalogue classification is therefore based upon the soluble salt content of the soil, but the basis of the field examination and classification will have to be physical as well as chemical, and soil maps will show the physical character, the kind and amount of alkali in the soil, and the drainage relation.

ALLUVIUM.

Localities:

Description.—The term "alluvium" is generally used in this catalogue in connection with the most recent river, lake, and ocean deposits designated as marshes, swamps, meadow, and bottom lands. There is a certain character about these lands that is well recognized in agriculture. Owing to their generally moist condition and proximity to water they usually maintain a luxuriant growth of vegetation, and owing partly to this and partly to the slow oxidation of the organic matter in the wet soil, they usually contain a high percentage of organic matter as a characteristic feature. When well drained they are generally very productive and adapted to certain classes of crops.

The group contains all classes of soil, however, from the very coarsest sands and gravels to the heaviest clay or to the purest muck and peat. The collection contains typical samples of salt and fresh water marshes, cranberry bogs, celery soils, rice lands, and sugar-cane lands of the Mississippi bottom and of Florida. The basis of the classification is thus physiographic and the group contains samples derived from various geological formations and having very different physical properties and chemical composition.

BAD LANDS

Locality:

	Page.
North Dakota, 5 samples	58

Description.—Large areas in the western part of South Dakota and contiguous parts of North Dakota and Nebraska are covered with alternate strata of indurated clays and soft marls of the Tertiary period. This soft material washes very badly whenever a stream forms, either of a permanent nature or resulting from the sudden and severe storms which occur. Yet the walls of the gullies and canyons thus formed have the requisite tenacity and firmness to stand up in perpendicular sides, and the surface of the land is traversed in all directions by deep channels, making cultivation impossible and traveling very uncertain and dangerous except with an experienced guide. Wherever vegetation has a chance to take hold the land is fertile and some of the broader valleys afford excellent grazing. The classification here is based on physiographic conditions, although this in itself must be based upon the chemical and physical peculiarities of the material.

BARRENS.

Localities:

	Page.
Alabama, 5 samples	22
Kentucky, 55 samples	40
Tennessee, 2 samples (*see* Subcarboniferous)	65
Virginia, 14 samples	66
Total, 76 samples.	

Description.—The term "barrens" is used in a different sense in different parts of the country, and the group really should be divided into "barrens" and "rich barrens," if indeed the latter term should not now be altogether discarded. The samples in the collection are properly distinguished by the terms just given.

The "rich barrens" of Kentucky have a level or gently rolling surface with broken or hilly country along the water courses. Much of this land was formerly devoid of trees and called "barrens," and later "rich barrens." It was really a prairie region and should have been designated as such. The cause of the treeless condition is popularly supposed to be due to prairie fires. At any event, since the country has become settled and these large fires prevented, a fine growth of hickory and oak has covered the country. The land is very fertile.

In contrast with this are the "barrens" proper, samples of which are contained in the collection, principally from Virginia. The soil is thin and underlaid at from 6 to 20 inches with an almost impervious "clay," usually white or mottled red and yellow with oxides of iron where air has access through cracks or root holes. This is usually not a true clay, but a silt having about the mechanical texture of loess. Similar soils occur on the Eastern Shore of Maryland, and are known there locally as "white-oak lands." Silt of this character, even when in good condition, is easily ruined by injudicious methods of tillage, and when it gets in the condition above described it is the most difficult of all soils to improve. Underdrainage and lime are the principal remedies, but the improvement is slow and costly. It is not known what gives this silt its wonderful plasticity when wet or what makes it so impervious when in certain conditions. It exhibits these properties to an extent rarely surpassed by true clay. This material is admirably adapted to investigate the cause of plasticity and the forces acting between grains of soil which determine their structure and their agricultural "condition" or "heart." The basis of this classification is thus seen to be in the physical properties of the soil.

BASALT.

Localities:

	Page.
Idaho, 2 samples	35
Texas, 1 sample	65
Washington, 29 samples	68
Total, 32 samples.	

Description.—The basalt covers an extensive plateau in central and southeastern Washington and contiguous portions of Idaho and Oregon. It is known agriculturally as the well-known wheat lands of the Palouse region. Over most of this locality the rocks have disintegrated to a great depth. The rich dark-red soil is 5 or 6 feet deep, and the subsoil, having the same texture and nearly as fertile, extends to 40 or 50 feet below this. The soil is fine-grained, containing but little true clay, and is quite free from gravel or coarse fragments. It can be easily worked and plowed. The extreme surface dries out rapidly, leaving a fine dust mulch which conserves moisture, and from other physical peculiarities crops are able to withstand long periods of drought without suffering in the least. From the nature of the minerals of the rock and the way it breaks down, the soils have a large percentage of potash, lime, and phosphoric acid. The basis of this classification is geological.

BENCH LAND.

Locality:

	Page.
Utah, 2 samples	66

Description.—The bench land of Utah, represented in the collection, is from terraces constituting at one time the shore line of the extensive

lake which covered the Great Salt Lake basin. The fertile valley lands were first settled, but gradually these low level lands have been almost inundated by the accumulation of seepage waters from over irrigation, and the agricultural districts are extending farther and farther up and out on these bench lands. The basis of this classification is the physiographic features, and the group might contain soils of very different texture and properties.

BENTON LIMESTONE.

Locality:

	Page.
Kansas, 12 samples	37

Description.—The basis of this classification is in the geological formation, and the samples present little of general interest beyond this.

BLACK WAXY SOIL.

Localities:

	Page.
Kansas, 1 sample (*see* Prairie)	38
Texas, 5 samples	65
Total, 6 samples.	

Description.—The black waxy soil of Texas, as the name implies, is very plastic and sticky when wet, and always hard to till. The material is so fine that the implements do not scour well. The soil has normally a very high water content. It contains a high percentage of potash, and is considered one of the most fertile soils of the State. The basis of this classification is thus the physical character of the soil.

BLUE-STEM SOIL.

Localities:

	Page.
Kansas, 5 samples (*see* Prairie)	38
Oklahoma, 1 sample (*see* Unclassified)	59
Total, 6 samples.	

Description.—The basis of this classification is the persistent character of the vegetation. The soil generally occurs in spots, covering small areas usually somewhat depressed and containing excessive amounts of alkali, but rarely enough to appear as a crust on the surface.

BLUFF LAND.

Locality:

	Page.
Louisiana, 41 samples	41

Description.—The bluff lands of Louisiana are similar to the hammock lands of South Carolina. They are adjacent to the water courses and have good elevation. The material is similar to, if not identical with, loess in texture and physical properties, and the lands are therefore well drained. The lands are fertile. The basis of this classification is in the physiographic relations, as well as the physical texture and condition.

BOWLDER CLAY—GLACIAL DRIFT.

Locality:

Description.—This is a finely ground mass of clay, varying in color, but usually white, blue, or buff, and containing varying quantities of sand, gravel, stones, and bowlders of all sizes and of a great variety of material. It is a form of glacial till. The rocks were ground by the moving glacial ice sheet to a fine, tenacious clay, still containing fragments of the rock masses which did the grinding and were being ground in all stages of disintegration. The thickness of this material in Illinois, where most of our samples were obtained, is said to reach the great depth of 400 and 500 feet in places. The basis of this classification is geological, and the group contains a variety of soils.

BUCKSHOT LAND.

Locality:

Description.—Hilgard regards the buckshot land as one of the most fertile soils of the Southern States. He describes it as "a stiff, dark-colored clay, traversed by numerous cracks and mottled with spots of ferruginous matter." These ferruginous concretions are often as large as buckshot, which they resemble. The soil is rich in all sorts of plant food. It is very retentive of moisture, yet well drained, and can have the deepest tillage. It may be tilled at almost any time, for if it turns up in wet lumps, these slake and break down into a fine tilth.

CAMBRIAN SANDSTONE AND SHALE.

Localities:

Description.—The samples in this group from Maryland came from a narrow belt on the west side of South Mountain, in western Maryland. It constitutes the famous mountain peach belt of that locality. The soil is a sandy loam, containing about 30 per cent of large stones, making cultivation difficult and adapting it to nothing but fruit-tree culture and small fruits. The elevation above the valley seems to insure the trees against damage from frost. The basis of this classification is geological, but it forms a distinct agricultural district.

CARBONIFEROUS.

Localities:

Description.—The basis for this classification is geological, and the group may include many types of soil.

CATOCTIN GRANITE AND SCHIST.

Locality:

	Page.
Maryland, 22 samples	44

Description.—This covers a small area in western Maryland which is of little agricultural importance. The basis of classification is purely geological and of very little general interest.

CATSKILL.

Locality:

	Page.
Maryland, 45 samples	44

Description.—Rather heavy, dark-red clay soil, formed from sandstone rock. It is moderately fertile. The basis of the classification is geological, and there are no particularly interesting features about it.

CHERNOZEM.

Locality:

	Page.
Russia, 7 samples	61

Description.—The chernozem is known as the "black earth" of Russia. It is a prairie region with a very deep, rich, black soil. The origin is still unknown, although many theories have been advanced to explain the formation and the relation to the adjacent loess. It is celebrated as a wheat region, and soil which has been under cultivation for a hundred years is said to show no deterioration. The investigations of the Division of Soils show it to be quite similar to the prairie soils of Illinois and the Red River Valley soils in Minnesota and North Dakota.

CHESAPEAKE.

Localities:

	Page.
District of Columbia, 2 samples	32
Maryland, 94 samples	44
Total, 96 samples.	

Description.—The Chesapeake covers a large area in southern Maryland with a moderately fertile clay loam. The most interesting general feature is the large area of rather strong clay, derived directly from the weathering of diatomaceous earth. This diatomaceous material weathers quickly, and within two or three years the white earth exposed in railroad cuts weathers to the compact yellow clay. Over these areas the diatomaceous earth is often found within a few feet of the surface, following the contour of the land. There is an opportunity for an interesting study here. The diatomaceous earth is so light and open in structure and contains so much air that a lump of it readily floats for a time in water. The diatoms are quite a pure form of silica. It is surprising, therefore, and suggestive that in the disintegration of this material a compact, rather tenacious clay is produced which can be used for brick. The basis for this classification is geological.

CLAYS—POTTERY, BRICK, TILE.

Localities:

	Page.
Delaware, 2 samples (china clay)	31
District of Columbia, 2 samples (brick and tile)	32
England, 1 sample (pottery)	32
Florida, 1 sample (kaolin)	32
Kentucky, 1 sample (crude ball clay)	39
Maryland, 10 samples (pottery, brick, tile)	44
Missouri, 1 sample (fire brick)	52
New Jersey, 1 sample (china clay)	54
New York, 1 sample (Albany slip clay)	55
Ohio, 5 samples (pottery)	58
Pennsylvania, 1 sample (pottery)	59
South Carolina, 1 sample (pottery)	61
Total, 27 samples.	

Description.—The general properties of commercial clay are (1) plasticity when wet, enabling useful objects to be molded and retain their shape on drying; (2) permanence and durability after burning; and (3) refractiveness under high temperature. Few other substances have these properties. Plasticity is a property which has never been satisfactorily explained. It is probably due to molecular forces acting between the fine grains, but these forces have never been thoroughly investigated. On account of the practical importance, not only in clay industries but in general agriculture in the condition and treatment of soils, as well as from the scientific interest of the subject, it should be thoroughly investigated.

The principal classes of high-grade clays are kaolin, china and porcelain clays, fire clay, and pottery clay. The low grade clays are shale, siliceous clay, tile clay, brick clay, and calcareous clay. The high-grade clays are more refractory than the other clays. The fusibility of a clay usually increases with the impurities other than sand. Potash increases the fusibility more than other impurities; iron is next; then lime, and then magnesia. Pure kaolin and quartz are infusible in any ordinary temperature of the kiln. The high-grade clays should not contain over 4 or 5 per cent of impurities; the low-grade clays contain often 20 per cent or more. As a rule brick clays should not contain over 3 per cent of lime, but some of the celebrated cream-colored bricks of the Northwest contain upward of 20 per cent of this substance, which entirely hides the color effect of the iron oxides. The low-grade clays contain from 10 to 70 per cent of kaolin base, from 2 to 5 per cent of alkalies, and two or three times as much of the other fluxes combined.

Albany slip clay is used to give a glaze and finish to stoneware. It is quite fusible at a high temperature, and as it burns into the surface it does not crack in cooling or in subsequent use. On account of the high temperature at which the Albany slip clay fuses, litharge or some other flux is mixed with it when glazing clay which can not stand the required temperature.

The ball clays are very tough, waxy, and plastic, and are used to mix with other clays which have not the required plasticity. Very pure clays shrink excessively when burned, and to counteract this ground flint (quartz) is mixed with the clay. In this case finely ground feldspar is added as a flux to get the mixture to fuse at a reasonable temperature. Calcined bones can also be used for this same purpose.

The basis for this classification is physical and chemical, and the property of plasticity is an interesting problem for the physicist.

CLAY SLATE.

Locality:

	Page.
South Carolina, 2 samples	61

Description.—The basis of this classification is geological and the formation has no particular general interest. The soil is a yellow clay loam, moderately productive.

CLINTON-NIAGARA.

Locality:

	Page.
Maryland, 13 samples	44

Description.—This formation occurs in several narrow bands in the mountains of western Maryland. It is of small agricultural importance and is interesting mainly from the geological derivation.

COAL MEASURES.

Localities:

	Page.
Alabama, 2 samples	22
Kentucky, 2 samples	39
Maryland, 35 samples (lower)	46
Tennessee, 2 samples	64
Total, 41 samples.	

Description.—The soils of the coal measures are, as a rule, very heterogeneous. They are usually alternate layers of limestone, sandstone, and shale, hard to differentiate, and as the country is of little agricultural importance and the formations are hard to follow out the group contains samples of different physical types. The basis of this classification is thus geological.

COLORADO GROUP—CRETACEOUS.

Locality:

	Page.
Nebraska, 14 samples (*see* Prairie)	53

Description.—The Colorado group of the Cretaceous, covering large areas in Kansas and Nebraska, is made up of limestones, shales, and clays which have not been separately mapped. The basis of the classification is geological and the collection contains samples of different physical and chemical properties.

COLUMBIA, LOWER (FOR UPPER COLUMBIA *see* TRUCK LAND).

Localities:

	Page.
District of Columbia, 5 samples	32
Maryland, 24 samples	45
Total, 29 samples.	

Description.—The Lower Columbia forms level terraces along the lower part of the Potomac River, and covers isolated areas along the water courses and adjacent plateaus in the District of Columbia and contiguous portions of Maryland. This high level phase, as it occurs along the plateaus, is not yet perfectly understood, and it is difficult to differentiate this from other formations.

The terraces along the Lower Potomac River vary in width from a quarter of a mile to a mile or more. They have an elevation above water of from 10 to 20 feet. At the back there are high bluffs of Lafayette material.

The soil is a fine silt with no coarse fragments and very easy to till. Agriculturally it resembles the bluff lands of the South. In mechanical composition it resembles loess, except that it contains a trifle less silt and rather more clay. It is very durable, and fields are said to have been cultivated for upward of two hundred years without apparent deterioration. The principal crops at present are corn, wheat, and tobacco. The basis of this classification is geological, and the soil is interesting from its uniform texture, the good heart, and the lasting qualities.

CORAL SAND.

Locality:

	Page.
Bermuda, 1 sample	25

Description.—The coral sand is an unconsolidated or disintegrated coral limestone. It is snow white and about the same texture as building sand. With the naked eye the larger grains are seen to be fragments of coral, and under a low-power microscope many beautiful and curious coral forms are seen. The sand in this form is nearly sterile, and few attempts are made to crop it. It is quite free from humus, and is almost entirely dissolved by dilute hydrochloric acid. Specimens of the coral limestone have been shown to contain 99.95 per cent of carbonate of lime. Where considerable areas of the rock are exposed in sections, layers of red earth are seen throughout it and covering the surface for a slight depth. This soil contains considerable clay, coral sand, and humus. It is upon such soil that the lilies and other staple crops of the island are grown. The carbonate of lime is relatively quite soluble in the natural waters. The impurities in the limestone, consisting of traces of silica, iron, alumina, and earthy phosphates, are relatively insoluble. As the carbonate of lime is dissolved and carried off by the percolating waters, these impurities are left behind and constitute the present productive soils of the island. The

basis of this classification is geological, and the group is interesting from the unusual form of the disintegration of the limestone rock and the evident and apparent example of the formation of soil from this class of rock by the simple process of disintegration and solution.

CORN LAND.

Localities:

	Page.
Alabama, 140 samples	22
Illinois, 63 samples	35
Iowa, 2 samples	37
Kansas, 71 samples	37
Kentucky, 172 samples	39
Louisiana, 157 samples	41
Maryland, 460 samples	45
Mississippi, 14 samples	51
Ohio, 49 samples	58
South Carolina, 38 samples	61
Tennessee, 109 samples	64
Virginia, 127 samples	66
Wisconsin, 18 samples (*see* Tobacco land)	69
Total, 1,420 samples.	

Description.—This group is simply a collection of all the samples upon which corn is at present considered an important commercial crop, either for home consumption or for export. The basis of classification is purely agricultural, and the group contains many types of soil, which are indicated under the appropriate States. No attempt has yet been made to correlate the usual yield per acre with the character of the formation. It is considered that in time this collection will form a valuable basis for such an investigation.

COTTON LAND.

Localities:

	Page.
Alabama, 140 samples	22
Florida, 11 samples (*see* Lafayette)	33
Louisiana, 191 samples	41
Mississippi, 14 samples	51
South Carolina, 65 samples	61
Tennessee, 16 samples	64
Total, 437 samples.	

Description.—The remarks under the group of corn land will apply equally well to this group.

CRANBERRY BOGS.

Localities:

	Page.
Massachusetts, 10 samples (*see* Alluvial soil)	49
New Jersey, 2 samples (*see* Alluvial soil)	54
Total, 12 samples.	

Description.—This is a fresh-water alluvial formation, consisting of muck, and contains frequently a large proportion of coarse fragments of roots and other portions of partly decayed vegetation as found in bogs. The lands are, as a rule, very wet and even subject to overflow in time of freshets. The subsoil may be either a compact sand or stiff

clay, in either case poorly drained. The basis of this classification is therefore partly geological, depending often upon physiographic relations, and partly agricultural. There is no apparent difference in physical properties or chemical composition between the cranberry and celery soils except perhaps in the depth of the overlying soil. With the proper exposure and situation a good celery soil would make a good cranberry soil; but the average cranberry soil, on account of the superficial depth of the soil and the poor surface drainage, would not necessarily make a good celery soil.

CRAYFISH LAND.

Localities:

	Page.
Louisiana, 2 samples (*see* Bluff land)	41
Virginia, 3 samples (*see* Barrens)	66
Total, 5 samples.	

Description.—The characteristics of this group have already been discussed under "barrens." They are sandy or silty soils, quite impervious to water, and on account of the poor drainage are not adapted to the staple agricultural crops. They are interesting from the peculiar structure, which renders them readily impervious to water, and from the opportunity they seem to present to the physicist to study the forces acting between the soil grains upon which the tilth of agricultural soils depends, but which is so marked in this case as to render the soil too close and impervious for agricultural crops. The basis of this classification is the physical structure of the soil.

CRETACEOUS.

Localities:

	Page.
Alabama, 7 samples	22
Louisiana, 2 samples	41
Maryland, 2 samples (*see* Marls)	47
Nebraska, 22 samples (*see* Prairie)	53
New Jersey, 16 samples	55
Tennessee, 4 samples	64
Texas, 5 samples (*see* Black waxy soil)	65
Total, 58 samples.	

Description.—The basis of this classification is geological, and whi e the samples in the collection are mainly loams and sandy loams adapted to fruit and truck growing, the group may contain very different types of soil. The collection contains a number of samples of glauconite sand (greensand), from which many of the samples in the collection have been derived. This glauconite is interesting not only from its chemical composition, which has never yet been satisfactorily worked out, but from its occurrence and mode of formation and the use which has been made of it as a fertilizer, especially in New Jersey, the agricultural value depending mainly on the potash and phosphoric acid it contains. This substance is not confined to this geological period or to any particular formation, but it has been principally described from the Cretaceous.

DAKOTA GROUP—CRETACEOUS.

Localities:

	Page.
Kansas, 3 samples (*see* Prairie)	38
Nebraska, 8 samples (*see* Prairie)	53
Total, 11 samples.	

Description.—Barbour thus describes this group:

Of the various kinds of rock above-mentioned as occurring in the Dakota group the sands, sandstones, and clays are most abundant and exert the greatest influence upon the soil. The clays are valuable for brick and pottery. Where they form continuous strata of considerable extent, with a level surface, the water is retained, causing boggy or swamp land. By themselves these clays impart too great heaviness and tenacity to the soil, but with a suitable proportion of sand intermixed a good loam is formed. An abundance of sand and sandstone is everywhere present in the Dakota group to temper the clays. In some places the sandstone predominates so much as to form sandy knolls, with a thin and poor soil or none at all. But these bald knobs are not numerous, and are never of great extent. The glacial drift and loess cover the country occupied by the Dakota group so generally that it is only on the high points projecting into the valleys that the sandstone foundation is in sight, making thin land.

The basis of classification of this group is thus geological, and the samples may be very different in texture and composition.

DEAD LAND.

Locality:

	Page.
New Mexico, 2 samples	55

Description.—This "dead land" is sand found along the bars and banks of some of the rivers in New Mexico. The coarser sand occurs in the bars. Much of the best land in some of the valleys is underlaid with this sand. Wherever it occurs within a foot or two of the surface fruit trees soon die. Grapes are said to do fairly well over it, and alfalfa to flourish. It appears to be quite free from organic matter or fertilizing material of any kind. The peculiar properties of the specimens and of the localities where it occurs have not been investigated. The basis of this classification is thus agricultural.

DEVONIAN BLACK SLATE.

Locality:

	Page.
Kentucky, 10 samples	39

Description.—The basis of this classification is geological, and the group may contain samples of different chemical composition and physical properties. As a matter of fact, the samples in the collection consist of samples of the "glades," the properties of which will be described under a subdivision of that name.

DIABASE.

Localities:

	Page.
Massachusetts, 1 sample	50
Virginia, 1 sample	66
Total, 2 samples.	

Description.—The basis of this classification is geological. The sample in the collection from Virginia formed the basis for an investigation by Dr. George P. Merrill[1] on the origin of soils and the chemical changes occurring in the disintegration and decomposition of rocks.

DIATOMACEOUS EARTH.

Locality:

	Page.
Maryland, 3 samples (*see* Chesapeake)	44

Description.—This group contains some interesting specimens of diatomaceous or infusorial earth, from which the soils over a large area of the Chesapeake formation in Maryland have been directly derived. This is discussed at length under the Chesapeake formation. The samples contain many beautiful and curious forms of diatoms.

DISMAL SWAMP LAND.

Locality:

	Page.
Virginia, 28 samples (*see* Alluvium)	66

Description.—The basis of this classification is physiographic. The swamp is of great extent, with an elevation above tide of from 10 to 25 feet. On account of the slight fall, the dense growth of vegetation, and the accumulation of peat the natural surface drainage is very slow. Some rather large areas on the edge of the swamp have been cleared, drained by open ditches, and cultivated for a number of years. The soil is a rich peat, from 1 to 10 feet thick, resting on a sandy subsoil which allows water to drain through it readily. The soils are quite acid, requiring frequent and heavy applications of lime. The water of the swamp and canals is also quite acid. It is of a dark color, quite free from sediment, and has long been noted for its excellence for drinking purposes on ship voyages. This property is usually attributed to a trace of tannin carried by the water. Fields which have been under cultivation for fifty years show a decided diminution of organic matter in the soil. Corn and hay grasses are the principal crops.

DRIFT.

Localities:

	Page.
Alabama, 2 samples	22
Connecticut, 11 samples (glacial)	30
Illinois, 15 samples (glacial)	35
Louisiana, 4 samples	41
Minnesota, 2 samples (glacial)	51
Ohio, 21 samples (glacial)	58
Rhode Island, 10 samples (glacial)	60
Total, 65 samples.	

Description.—The basis of this classification is geological, and includes glacial and nonglacial drift soils, the former belonging, like the bowlder clay, to the broad class of glacial till. The group contains different kinds of soil.

[1] The Weathering of Rocks, Part III. Rocks, Rock Weathering, and Soils.

EOCENE.

Localities:

	Page.
District of Columbia, 4 samples	32
Maryland, 24 samples	45
Total, 28 samples.	

Description.—The basis of this classification is geological, and the group may contain soils of different chemical composition and physical properties. Most of the samples in the collection are light loams, adapted to peaches and the heavier truck crops. Most of the samples have been derived directly from the green glauconite sand (greensand). They are easy to till and as a rule very productive for the class of crops adapted to them.

ETONIA SCRUB.

Locality:

	Page.
Florida, 9 samples	33

Description.—The basis of this classification is agricultural, depending especially upon the character of the native growth. The scrub occurs in spots, often of large extent, in Florida. The soil is a light, sandy loam, and there is no apparent reason for the difference in vegetation and in agricultural value between this and the adjacent high pine land. The following extract, from Bulletin No. 13 of this Division, will show the characteristics of these lands and the interesting problem presented in an investigation of the cause of their peculiarities:

> The great Etonia scrub formation was examined at Altoona. It is an impressive sight to stand at the border line between the scrub and the high pine land and notice the difference in the character of the vegetation. The high pine land is open, the trees are large and vigorous, and the ground is covered with a crop of grass which gives very good grazing for cattle. The vegetation is quick and generous, and the most tender garden plants will grow luxuriantly if properly attended to. These conditions stop abruptly at the edge of the scrub. The boundary between the high pine land and the scrub can be located without trouble within a few feet.
>
> In the scrub there is a dense growth of scrub oaks and low bushes and plants, all having thick leaves protected to the utmost from loss of water by evaporation by the property that desert plants have of turning the leaves up edgeways to the sun to expose as little surface as possible to the direct rays. No grass is found, and only the most hardy desert plants grow. When pines grow it is the dwarf spruce pine and not the long-leaf pine, while on the other hand the spruce pine is not found across the border in the high pine lands proper.
>
> The full-grown scrub vegetation reaches about the height of a man's head. This scrub growth stretches out at this place in an unbroken line for 10 or 15 miles to the northward, and the whole country presents a most desolate appearance. The country is generally rolling in both the high pine land and scrub. There are lakes at which the scrub and the high pine vegetation meet at the water's edge. There is no indication from the topography of the country of any difference in the climate over the two soils. Very few attempts are known to have been made to cultivate the scrub lands. A few efforts to grow truck and oranges are known to have been failures. It is generally believed that the scrub is colder at night, and that frosts are liable to occur over these areas when they do not occur over the high pine land. There is no apparent reason for this, however, in the topography of the country.

There are differences in elevation in the scrub in quite short distances of 25 feet or more, over which the same growth extends in an unbroken line following the contours of the surface. The same character of growth extends down to the lake borders in what is almost a muck soil. * * * There is no apparent reason, from the chemical or physical examination, to account for this difference in the native growth on the scrub as compared with the high pine land or the hammock, and, so far as our investigations show, there is no difference in the soil. The only explanation for the difference in the character of the vegetation is that it is accidental, and that the one kind of crop or the other received a start and simply spread, the two kinds of vegetation not being capable of growing together. As a matter of fact, however, in comparing the scrub with the high pine land the conditions in the scrub appear more natural than those in the high pine land. In such sandy soils as these the wonder is that tender vegetables can be grown at all, and that such a large and generous growth of pines and grass is naturally produced.

FLATWOODS.

Localities:

	Page.
Alabama, 3 samples (post oak)	24
Florida, 3 samples	33
Mississippi, 2 samples	51
Tennessee, 4 samples (*see* Cretaceous)	64
Total, 12 samples.	

Description.—The basis of this classification is agricultural. Along the South Atlantic and Gulf coast there is a strip of low, flat land having at present very little agricultural value. It is usually not immediately adjacent to the coast but separated by a strip, often not more than a mile or a few miles wide, of better-drained and more productive land. In this broad classification there is little difference in the soils of the lower pine belt of South Carolina and the pine flats or flatwoods of Florida and Mississippi. Hilgard gives the following description of the flatwoods and pine flats of Mississippi in the volume on cotton production, of the Tenth Census, which describes very well the soils of the whole area:[1]

The flatwoods region of Mississippi is throughout underlaid by a strata of heavy gray clay belonging to the older Tertiary formation from which its prevalent soil is almost directly derived. The gray, heavy, intractable soil bears almost throughout a moderately dense growth of post oak, interspersed with short-leaf pine and black gum, and varied with occasional belts or tracts of small-sized, round-headed black-jack where the soil is excessively heavy. * * * Near the streams the growth becomes more sturdy. The streams have scarcely any true bottoms. The drainage is therefore exceedingly slow, and during winter rains the country over large areas is covered with a shallow, slow-moving sheet of muddy water. This, together with the tenacity and depth of the mud, renders the flatwoods belt almost impassable to teams in winter and far into spring. The soil frequently remains untillable until the planting season is nearly over, and thus subjects the crop to uncertain chances of a short growing season; yet in favorable years, when water subsides early and plowing can be done, very good crops of corn and cotton are made.

The soil of the pine flats proper is not materially different from that of the pine prairies. It is a whitish or gray, unretentive silt, with brown ferruginous or rusty spots, increasing downward, and indicating a lack of drainage. The cause is found,

[1] Tenth Census, Vol. V, Cotton Production in Mississippi, Part 1, 1880, p. 23.

at 18 or 30 inches, in a compact, whitish, or bluish subsoil, full of bog-ore gravel, and consisting generally of siliceous silt compacted by clay, or sometimes true clay, almost impervious to water and of the consistence of putty, where it is brought up by the crawfish that inhabit the lower tracts.

In ill-drained tracts the subsoil becomes whitish by the formation of concretions of bog ore or black pebble, and thus the soil becomes poorer than in the uplands, unless enriched by sediment. This kind of "pine flat soil" is about the least esteemed in this region, as even its timber growth is often quite stunted.

FOX HILL SANDSTONE.

Locality:

	Page.
Montana, 2 samples	52

Description.—The basis of this classification is geological. The samples are interesting in being derived from the Fox Hill sandstone which is one source, although not the principal source, of the alkali in the Yellowstone Valley.

FRESNO PLAINS.

Locality:

	Page.
California, 12 samples	27

Description.—The basis of this classification is physiographic and the group contains many kinds of soil. Among the most interesting to the student of soil problems, as well as among the most valuable agriculturally, are samples representing a considerable area where subirrigation is practiced on a relatively enormous scale. Over these areas standing water in the wells, which before the practice of irrigation was introduced stood at a depth of 80 to 100 feet or more from the surface of the ground, is now found at a depth of from 6 to 12 feet. It is no longer necessary to irrigate the fields provided the water is allowed to run in the main irrigating canals, which may be located at distances of one-half a mile or a mile apart, notwithstanding the fact that the normal rainfall for the summer months is less than 5 inches in the aggregate. The seepage from the canals supplies the crops with necessary moisture. These interesting features were brought out in an article in the Yearbook for 1897, entitled "Some interesting soil problems."

FULLER'S EARTH.

Localities:

	Page.
England, 1 sample	32
Florida, 11 samples	33
Nebraska, 1 sample	52
Total, 13 samples.	

Description.—Fuller's earth is a rather pure clay or impure kaolin, appearing unceous to the touch. It is extensively used for fulling and whitening cloth and for filtering purposes and clarifying oils and sirups. The properties which contribute to this are not clearly understood, and the only way at present of judging of the filtering and clarifying value, as with the brick and pottery clays, is an actual trial under the conditions of practical commercial work. As prepared for market, the material after being washed and dried is ground and sifted into many grades of fineness for different commercial purposes.

GABBRO.

Localities:

Description.—The basis of this classification is geological. The soils are quite uniform, strong clay lands, generally quite productive. A good opportunity is afforded in the area covered by these rocks to study the formation of soils from the disintegration and decomposition of the older crystalline rocks in place—supposed to be one of the ultimate sources of the vast areas of sedimentary rocks and soils which cover by far the larger part of the surface of the country.

GALENA LIMESTONE.

Locality:

Description.—The basis of this classification is geological, and there is no other general interest attached to the sample in the collection.

GLADES.

Localities:

Description.—The "glades" are locally and very expressively known as mountain swamps. Occurring at high altitudes, they are generally level stretches, underlaid by an impervious clay, and almost always covered with more or less water. They are difficult and expensive to drain on account of the topography and the nature of the substratum. They are at present of little agricultural value.

GLASS SAND.

Localities:

Description.—Glass sand is a pure white quartz sand of different degrees of fineness used for glass manufacturing. It has no value as an agricultural land, and indeed is found in only few localities and then covered with other material. It is frequently used in pot experiments with fertilizers as a sterile medium out of which to construct an artificial soil of any chemical composition or containing any combination of salts. The basis of this classification is thus the commercial use and value of the material.

GNEISS AND GRANITE.

Localities:

Description.—These residual soils are from the disintegration and decomposition of gneiss and granite rocks. The minerals of the rock are almost completely decomposed and unrecognizable, except the quartz and mica—the latter being a very characteristic feature, in the gneiss soils particularly. The gneiss soils of the Piedmont Plateau are strong red clays, very fertile in the northern part and adapted to general agriculture, but washing or eroding badly in the southern portion of the area. The basis of this classification is geological.

GRANITE (*see* GNEISS AND CATOCTIN).

Description.—The collection contains only a very few samples of true granite soils. These vary from light sandy soils to stiff clays, depending partly upon the composition of the original rock and partly upon the extent of decomposition of the minerals.

GRASS LAND.

Localities:

	Page.
Kentucky, 138 samples	39
Maryland, 330 samples	45
Ohio, 11 samples	58
Pennsylvania, 24 samples	59
Tennessee, 93 samples	64
Total, 596 samples.	

Description.—The samples in the collection grouped under this head come only from the Eastern States, from lands upon which the hay crop takes a prominent place in the crop rotation. It has not been thought wise or practicable to include in this group the purely pasture lands. This is often a matter of mere local environment—such as distance from markets, lack of transportation facilities for crops, rough and mountainous topography of the land. The samples in this group all have heavy clay subsoils, containing 25 per cent or more of clay and averaging 30 or 35 per cent of clay. The soils represented in the collection are all adapted to wheat and corn, although the strongest grass lands are usually too heavy for the best wheat crops, as the crops are liable, especially in wet weather, to develop an excessive growth of straw, which is liable to lodge and develop disease. They are still less adapted to the best development of the corn crop. The basis of this classification is thus agricultural.

GREENHOUSE SOIL.

Localities:

	Page.
California, 2 samples	28
Connecticut, 1 sample	30
District of Columbia, 2 samples	32
Illinois, 1 sample	36
Indiana, 2 samples	36
Maryland, 2 samples	45
Massachusetts, 10 samples	50
Michigan, 4 samples	50
Minnesota, 1 sample	51
New Jersey, 6 samples	55

Localities—Continued.

	Page.
New York, 21 samples	55
North Carolina, 1 sample	56
Ohio, 1 sample	58
Pennsylvania, 17 samples	59
Vermont, 1 sample	66
Total, 72 samples.	

Description.—With the control of temperature and moisture in greenhouse culture it is possible, with judgment and skill, to grow nearly all crops on almost any kind of soil; still the recent development in the specialization of certain greenhouse crops marks certain localities as particularly adapted to certain crops—for example, Boston for lettuce, Poughkeepsie for violets, Kennett Square, Pa., for tomatoes, and so on. This is partly due to particular care and skill in the local development of the industries, partly to climatic conditions of sunshine, and largely, it appears from the investigations of the Division of Soils, to the soil used. The collection includes samples of soil from which the finest commercial crops are grown, such as lettuce, tomatoes, roses, carnations, and violets. No general results have yet been obtained in attempting to correlate these with the texture of the soil and the crop produced, which is the object of the collection. The basis of this classification is agricultural.

GUMBO.

Localities:

	Page.
Illinois, 1 sample (*see* Prairie)	36
Iowa, 7 samples	37
Kansas, 4 samples (*see* Prairie)	38
Minnesota, 2 samples (*see* Lacustrine)	51
Montana, 10 samples (*see* Prairie)	52
New Mexico, 1 sample	55
Total, 25 samples.	

Description.—This is a local term applied in the South and West to a tough, dark-colored mass exhibiting plasticity and clay-like properties to a remarkable degree. It is very sticky and difficult to till when wet, and when dry it breaks with a cuboidal fracture in very hard lumps. Farmers dislike to find it near the surface of their lands, as it is so very difficult to till or improve. While exhibiting all the plastic properties of clay in a marked degree, it does not necessarily contain a high clay content, as it may consist mainly of silt or of very fine sand. By deep plowing and cropping, and especially by greenhouse manuring, these soils may be gradually improved. It is advisable to keep them in hay crops for a few years. The basis of this classification is the physical character of the soil.

GUNPOWDER LIME LAND.

Locality:

	Page.
Alabama, 2 samples	23

GYPSUM SOIL.

Locality:

	Page.
Kansas, 3 samples (*see* Prairie)	38

Description.—Recent investigations by the Division of Soils of the gypsum soils of New Mexico show this to be a very unusual and, from a soil physicist's standpoint, a very interesting soil. It is derived from the disintegration of the gypsum rock. It is usually covered with a layer of loam from 1 to 2 feet thick, grading down into the more or less pure gypsum formation. The soil and especially the subsoil frequently contain fragments or crystals of gypsum which easily crumble between the fingers. In some places it is said to exist as white sandy soil and subsoil. In most cases, however, where thoroughly disintegrated, it is a white impalpable powder when dry. In natural lumps it absorbs water readily and falls apart into a sloppy mass, resembling slacked lime when mixed for mortar. It has a remarkable power of allowing seepage waters to flow readily and rapidly through it. Great damage is frequently done in the irrigated districts where the canals flow through areas underlaid by this substance. The canals occasionally lose as much as 15 or 20 per cent per mile, and large areas below the canal may be flooded or swamped by the seepage water. This damage may extend several miles from the ditch, even where no water is applied to the surface of the land in the immediate vicinity. This is locally known as subirrigation. When such lands are directly irrigated, great care must be taken not to injure the land and the surrounding area by an accumulation of seepage waters. In sampling such soils, after the first 12 or 18 inches are drawn up, it is no unusual thing for the auger to suddenly drop 2 or 3 feet with little or no pressure on the instrument. Cattle frequently get swamped and perish in these areas. The material has such a remarkable power of drawing water up, by capillary power, that even above and some distance from the ditches and on land of much higher elevation, the surface may be quite wet after months of dry weather, even where standing water is from 10 to 20 feet below the surface. The basis of this classification is the chemical composition and physical property of the material.

HAMILTON-CHEMUNG SHALES.

Locality:

	Page.
Maryland, 36 samples	45

Description.—The Hamilton-Chemung shales are generally thin soils in elevated plateaus and valleys of western Maryland, used mainly as pasture lands. The basis of this classification is thus geological.

HAMMOCK.

Localities:

	Page.
Alabama, 6 samples	23
Florida, 59 samples	33
Louisiana, 2 samples	41
South Carolina, 10 samples	61
Total, 77 samples.	

Description.—The term hammock, or hummock, is used in the Southern States to designate certain areas characterized by a more or less

dense growth of hard-wood trees and made more conspicuous by the surrounding pine forests. The basis of this classification is thus botanical. The following description is from Bulletin No. 13 of this Division:

The hammock lands of Florida, which have been principally studied, are characterized by a native growth of hard-wood trees, principally of oak, hickory, magnolia, dogwood, and the cabbage palmetto. There are quite a number of grades of hammock land, distinguished by the kind and density of the growth as well as by the character of the soil. There are light and heavy hammocks, so named from the density of the growth rather than from any appreciable difference in the character of the soil, the low, flat hammock, the high hammock, the heavy clay hammock, and the marl hammock, the various grades differing somewhat in the kind and relative proportion of the native trees.

As indicated by the name, there is considerable difference in the texture of some of the hammock soils, but by far the largest area which has been studied consists of the light hammock and the heavy gray hammock, between which there is no apparent difference in texture. The soil and subsoil of these two hammocks consist of a moderately fine sand, containing less than 5 per cent of clay. The heavy hammocks are very dark colored from the accumulation of organic matter from the dense growth which they have maintained in the past. This black soil is light and porous and has the tilth of an excellent garden mold. It has a depth of from 1 to 3 feet.

These hammock lands are considered the most valuable in the State for general agricultural purposes. For special industries, however, especially for pineapples and some of the early truck crops, some of the other types of soil in the State have a higher value. The hammock soil at Fort Meade maintains about 8 per cent of water on the average, which is about twice as much as the high pine-land truck soils at Winterhaven maintain. It seems strange, indeed, to a person familiar with the soils of the Northern and Western States, to see such a luxuriant growth of oak, hickory, and other hard-wood trees on such light sandy soil as this.

HARDPAN.

Localities:

	Page.
Alabama, 1 sample (*see* Barrens)	22
California, 2 samples (*see* Mojave Desert)	28
Connecticut, 1 sample (*see* Unclassified)	30
Total, 4 samples.	

Description.—This term applies to a hard, compact, and often nearly impervious layer which is found to exist or may form at a short distance below the surface of the ground. It is frequently due to an accumulation of lime or iron compounds, reduced and deposited as a cementing medium, in a thin layer at a nearly uniform distance below the surface. Frequently it is in a layer of gravel which becomes so firmly cemented and so impervious that it must be broken with a pick or blasted with dynamite before trees can be successfully grown. Such formations usually indicate a lack of air and insufficient drainage at the present or some previous period. Hardpan frequently forms, as Hilgard has shown, by a local accumulation of alkali, especially of sodium carbonate, at the average depth to which rain water penetrates. Lastly, hardpan may form as a result of continuous plowing at a uniform depth, the sole of the plow smoothing down or puddling the layer over which it moves. This is usually broken up readily by deeper plowing or by use of the subsoil plow. There is no satisfactory explanation of the cause of the formation. It is a subject of considerable

agricultural importance, and it requires and deserves further investigation. The basis of this classification is thus the physical property of the material.

HELDERBERG LIMESTONE.

Locality:

	Page.
Maryland, 21 samples	46

Description.—This is a strong clay soil resulting from the disintegration of the Helderberg limestone, a magnesium limestone from which hydraulic cement is extensively made. The subsoil has a rich yellow color, very retentive of moisture, and makes a safe and fertile soil for general agricultural purposes. The surface of the country is rolling, offering a succession of sharp hills and valleys which are uniformly fertile. The basis of this classification is geological.

HIGH PINE LAND.

Locality:

	Page.
Florida, 37 samples	33

Description.—The basis of this classification is botanical. The following description of the pine lands of Florida is taken from Bulletin No. 13 of the Division of Soils:

There are four important grades of pine land in the State—the pine flats or "flat woods," and the first, second, and third quality of high pine land.

The soils of the pine flats have not been particularly examined, as they need underdrainage in order to make them at all productive. Besides being an expensive operation, this is at times an exceedingly difficult one on account of the flatness of the country and the slight fall which can be obtained to carry off the surplus water. The growth on the pine flats consists of the long-leaf pine, palmetto, and grasses. The woods are open and very irregular in density; the soils are generally wet, with standing water from 1 to 4 feet below the surface. But few attempts have been made to reclaim or cultivate these flat woods on any extensive scale.

The first quality of pine land occurs only in small areas. It has a dark, rich, light sandy soil, in which a stick can often be pushed with ease to a depth of 2 or 3 feet below the surface. It has a very dense growth of long-leaf pine, so dense in fact that the trees are small, and for this reason it is frequently called "sapling" land.

The soil, though loose and open like a garden soil in excellent tilth, holds together well, and has the property of taking any impression when molded in the hand, as a good quality of molding sand does. On drying it is not inclined to fall apart to a loose, incoherent condition, and roads through it have generally a compact, hard surface, very easy for traveling. This soil is very similar to the hammock and is considered quite as valuable as the hammock land for general agricultural purposes.

The second quality of high pine land covers vast areas in the peninsula. It is a very light, rather coarse, sandy soil, less coherent than the hammock or first quality of pine land. Still the roads through it are good. The characteristic growth is the long-leaf pine. The trees are sparsely set and often of quite large size. There is very little undergrowth and a wagon or carriage can be driven through the forest in almost any direction. There is generally a good growth of grass, and these lands are very extensively used for grazing.

These second quality high pine lands form the principal truck areas at Gainesville, Orlando, Winterhaven, Grand Island, and Bartow. The country is generally rolling, with differences of elevation of from 25 to 50 feet. The whole elevation of the lake region, which is extensively used for truck growing, is from 100 to 200 feet

above sea level. The soil is a coarse white or yellow sand, underlaid by a coarse, sandy subsoil. It looks like a barren sea sand, or a coarse, sharp, building sand, but that it is very productive is shown by the large and vigorous growth of pines, the luxuriant growth of grass, the great quantity of truck crops which can be produced during the season, and the enormous growth of beggar weed which takes possession of the land after the crops are removed.

These second quality high pine land soils seem particularly adapted to truck growing. The climate of the region is such that the crops can be grown during the winter and placed upon the Northern markets during the winter and early spring. The winter months constitute the dry season of this locality. A particularly valuable property of these soils is the evenness of the water supply which they maintain. The surface of the ground quickly dries after a rain, and for a depth of an inch or two it is soon as dry as dust. Immediately below this depth, however, the sand is always moist. Truck crops seldom suffer on these soils from drought. It is claimed that in one year a crop of tomatoes was secured with but 1 inch of rain from the planting to the harvesting of the crop. Certainly a dry period which would cause a most disastrous drought upon the soils at the North appears to have hardly any effect on the crops of these truck soils. Several weeks after a rain the soil immediately under the dry surface is so moist that it will hold together when molded in the hand.

Four per cent of water seems to be an abundant supply for these truck lands, and 6 per cent makes the soil quite wet. During an entire season the water supply in the soil at Winterhaven, at a depth of 3 to 6 inches, has never fallen below 3 per cent, although there have been periods of fifteen or twenty days without rain.

No reason can be assigned for the peculiar property these soils possess which enables them to maintain such a uniform water content. The soils are comparatively high, and the wells throughout the area are comparatively deep. Standing water is found on the average about 15 or 20 feet below the surface of the ground. Nowhere in the Eastern States are there soils similar to these where such a uniform water supply can apparently be maintained regardless of the frequency or amount of the rainfall. There are, however, in the Northwest, in southern California, and in Texas, soils which have this same power of withstanding drought to an even more marked extent than these high pine land soils. On some of these Western soils it is no unusual thing for crops to thrive for a period of five or six months without rain and without irrigation.

The third quality of high pine land consists of very loose and incoherent sand which, on drying, falls apart, so that the roads are exceedingly sandy and heavy for teams. The native growth of pine has little value. The soil is very poor and is not generally considered fit for cultivation.

HOGWALLOW.

Localities:

	Page.
California, 1 sample (*see* Fresno Plains)	28
Louisiana, 2 samples (*see* Long-leaf-pine hills)	41
Total, 3 samples.	

Description.—The basis of this classification is the physical condition of the soil. The following definition of "hogwallow" lands is taken from two of Dr. Hilgard's papers in the agricultural volume of the Tenth Census:[1]

In California we find the singular rounded hillocks, popularly known as "hogwallows," from 10 to 30 feet in diameter and from 1 to 2 feet high. These hillocks are

[1] Tenth Census, Vol. VI, Part II, Cotton Production in California, 1880, page 19; also Vol. V, Part I, Cotton Production in Mississippi, 1880, page 55.

most abundant near the foothills, with long scallops toward the valley, and the tracts seem to diminish in width toward the axial "trough," which they seldom reach. They occur on all kinds of soil, and even on the rolling foothill lands themselves, constituting an obstacle to easy cultivation that is sometimes costly to remove, the more as their material is usually somewhat more compact than that of the intervening lower soil, and their leveling involves baring of the subsoil. In some cases they are thickly set and resistant so as to render the land valueless for ordinary cultivation. They are almost always present on strongly alkaline soils and bear good grain crops, while on the lower portions of the land the soil is whitened with alkali and grain is dying. In other cases, owing to differences in capillary power of the soil in the two locations, the reverse is seen. "Hogwallow land" does not imply any definite character of soil in general, although locally the character is often an exceedingly definite and distinct one.

A sample of "hogwallow subsoil" from Jasper County, Miss., shows 48 per cent of clay. It is no wonder that the soil is found excessively refractory in tillage, as it entirely lacks the quality of many of the black prairie soils of "slaking" or pulverizing in passing from wet to a dry condition. In that process it cracks open into widely gaping fissures, and is wetted with difficulty. When wet it becomes excessively tenacious; when taken under the plow in the right condition it assumes fair tilth and in good seasons yields fair crops.

In "hogwallow" soils the lime percentage is uniformly lower, falling below five-tenths—from 0.13 to 0.43. Phosphoric acid is low, the humus a little over one-half of that in the black prairie soils, and about the same as in other good upland soils.

In order to render "hogwallow" soils more similar, chemically, to black prairie soils, they should be supplied with more lime, which, with green manuring, would supply deficient humus.

The mechanical condition of these soils stands in the way of productiveness, and this would in a measure be remedied by the application of lime and vegetable matter, but in addition thorough tillage and good drainage are essential. It is probable that simple underdrainage and use of lime would render these soils fairly and uniformly productive.

HUDSON RIVER LIMESTONE (*see* TRENTON LIMESTONE).

Description.—The soils of this formation are quite similar to and closely associated with the Trenton limestone, which is described in detail in another place.

HUDSON RIVER (MARTINSBURG) SHALES.

Locality:

	Page.
Maryland, 25 samples	46

Description.—The samples in the soil collection of the Division, derived from this formation, represent rather a small area in western Maryland where the rocks cross the State in a low, flat, narrow ridge near the west side of the Cumberland or Hagerstown Valley. The soil is a rather light clay loam, usually containing small fragments of shale.

The subsoil contains a large amount of small fragments of soft and partially decomposed shale, so that it is difficult to bore for samples to a depth of 18 inches. The soil is fairly well adapted to wheat, but the crop is neither as safe nor as certain as on the adjacent limestone lands. It is very dependent upon the character of the season. It is well adapted to the growth of rye. Peaches do fairly well, but the crop is uncertain.

Apples and pears do better. The soil, as a whole, requires careful farming to keep it in good condition. It responds well to fertilizers and is greatly benefited by green manures.

JAMESTOWN VALLEY (*see* LACUSTRINE).

Locality:

	Page.
North Dakota, 11 (*see* under Prairie)	58

Description.—These samples represent some of the immense wheat farms near Fargo, N. Dak. The Jamestown Valley at this point is about 50 miles broad and almost perfectly level. The soil is very dark in color and from 1 to 3 feet deep, or more. It is a very heavy loam, partaking of the nature of gumbo at times. During rainy periods the surface drainage is hardly sufficient to carry off the water as it falls, and the soil is so close and sticky that the roads become quite muddy and often nearly impassable. The soil contains rather a high percentage of organic matter. It is used almost exclusively for the production of a very fine quality of hard wheat. The farming is on an immense scale, and the cultivation is, as a rule, very superficial. This probably accounts for the low average yield of only about 12 bushels per acre upon soil which should and does under good cultivation give 40 or 50 bushels. The soil is a lacustrine or fresh-water deposit of the great Lake Agassiz, which formerly covered an immense area. The soils are quite similar, both in chemical composition and mechanical texture, to the famous wheat lands of the black-earth deposit or chernozem of Russia.

KAOLIN.

Localities:

	Page.
Florida, 1 sample (*see* Clay, pottery)	32
Total, 1 sample.	

Description.—The basis of this classification is the chemical composition and commercial use of the material. The sample of kaolin in the collection is derived mainly from the decomposition of highly feldspathic gneisses. As the gneiss rock contains, in addition to feldspar, both quartz and mica, the resultant clay is more or less colored with iron and contains fragments of quartz and undecomposed feldspar. It is nearly always more or less impure. Where the mica has been very abundant the iron stain is so pronounced as to make the resultant clay suitable only for low-grade stoneware. The kaolin used for the manufacture of pottery has to be washed and freed from impurities in nearly all cases. The kaolin contains many crystals characteristic of true kaolinite. A sample of washed kaolin analyzed by Professor Merrill[1] contained 48.73 per cent of silica, 37.02 per cent of aluminum, and 12.83 per cent of combined water. This same sample gave by mechanical analysis 30.86 per cent of silt, 7.31 per cent of fine silt, and 47.78

[1] Bull. 150, U. S. Geological Survey, 1898, page 384.

per cent of clay. Professor Merrill shows the material to be far from uniform in composition, carrying abundant crystalline particles, such as quartz granules and shreds of undecomposed feldspar. The alkalies resulting from the decomposition of the feldspar have almost entirely disappeared and over 12 per cent of water of crystallization has been taken up. The collection contains samples of crude kaolin and of the washed kaolin as used in the manufacturing of high-grade pottery.

KAOLINITE.

Locality:

	Page.
Colorado, 1 sample	29

Description.—This is a finely crystalline mineral, in loose crystals of almost microscopic size. It is contained in kaolin, in many impure clays, and is found in pure deposits in very few localities. It was formerly assumed to be the basis of all clays, but in itself and in a pure state it has none of the properties of clay. It is not plastic, nor does it contain as much capillary water as clay does. It is loose and granular. The modern conception of the properties of clay is entirely different from this early conception, and the properties of a clay now are ascribed to certain properties of finely divided matter of various kinds. (See definition of clay under the appropriate head.)

KEOKUK.

Locality:

	Page.
Kentucky, 2 samples	39

Description.—The samples are of interest merely as representing a certain geological formation.

KNOX DOLOMITE.

Localities:

	Page.
Alabama, 13 samples (*see* Limestone)	23
Tennessee, 6 samples (*see* Limestone)	64
Total, 19 samples.	

Description.—These samples are interesting as representing a geological formation and as being derived from a magnesium limestone. It is typically developed in Tennessee, where it forms a soil of considerable local importance.

KNOX SANDSTONE.

Locality:

	Page.
Tennessee, 3 samples (*see* Cambrian)	63

Description.—The samples from this formation are from Tennessee. They are interesting agriculturally, as they form some of the important fruit lands and bright-tobacco lands of east Tennessee. The basis of this classification is geological.

KNOX SHALES.

Locality:

	Page.
Tennessee, 2 samples (*see* Cambrian)	63

Description.—These samples are interesting mainly from a geological standpoint and offer no particularly interesting agricultural features.

LACUSTRINE (*see* JAMESTOWN VALLEY SOIL).

Localities:

	Page.
Minnesota, 12 samples	51
North Dakota, 17 samples	58
Total, 29 samples.	

Description.—Lacustrine is a general term for deposits from fresh-water lakes, but it is applied in almost a specific manner to the vast deposits of the old glacial Lake Agassiz, in Minnesota and North Dakota, a prominent agricultural feature of which is the Jamestown Valley, which has been described under another head. The deposits may be of any sort of material, ranging from the coarsest sands and gravels to the finest clay. The basis of this classification is thus geological.

LAFAYETTE.

Localities:

	Page.
Alabama, 54 samples	23
District of Columbia, 12 samples	32
Florida, 11 samples	34
Louisiana, 8 samples	41
Maryland, 15 samples	46
Tennessee, 10 samples	64
Total, 110 samples.	

Description.—The Lafayette formation has been very elaborately investigated and described by W J McGee. The formation extends from New Jersey along the Atlantic coast and Gulf States. It is made up of gravels, sands, and clays, and, as a rule, gives very poor soils. The samples in the collection are derived mainly from the pine barrens of southern Maryland, and most of them are coarse sands, having little or no agricultural value. The cause of the unproductiveness of these sands offers an interesting field for investigation, as they have sufficient plant food, and sands of equal coarseness in other localities have considerable value for certain plants and agricultural industries. Nothing has yet been tried on this particular formation, however, with any marked degree of success. There is no reason why some crops should not be found adapted to these lands, and the area become of recognized agricultural value in consequence of special adaptation to the conditions. The basis of this classification is geological.

LAKE ERIE BOTTOM.

Locality:

	Page.
Ohio, 16 samples	58

Description.—The basis of this classification is physiographic. This is a series of samples collected by Mr. A. J. Pieters in investigating the flora of the bottom of Lake Erie in some work for the United States Fish Commission. The samples were taken at various distances from the shore and at different depths. They range from a coarse sand, found near the shore, to a fine clay of greater depths. The texture was not entirely determined by the depths, but in part by the conformation of the lands and the currents. There appears to be a marked

relation between the texture of the soil and the flora. About one-half of the samples contained over 20 per cent of clay. These had little or no vegetation, whether they were in deep or shallow water. The vegetation is confined almost exclusively to soils containing less than 20 per cent of clay. The results of this will probably be embodied in the report of the commission.

LENORE LIMESTONE.

Locality:

	Page.
Tennessee, 4 samples	64

Description.—This formation has given some of the most fertile lands of middle Tennessee, including the blue-grass region of that State. The soils are strong clay lands, quite similar to the Trenton limestone lands of Kentucky, Virginia, Maryland, and Pennsylvania.

LIMESTONE.

Kinds and localities:

	Page.
Benton—	
Kansas, 12 samples (*see* Prairie)	37
Carboniferous—	
Kentucky, 20 samples	39
Galena—	
Illinois, 1 sample (*see* Prairie)	36
Gunpowder lime land—	
Alabama, 2 samples	23
Helderberg—	
Maryland, 21 samples	46
Hudson River (*see* Trenton).	
Keokuk—	
Kentucky, 2 samples	39
Knox dolomite—	
Alabama, 13 samples	23
Tennessee, 6 samples	64
Lenore—	
Tennessee, 4 samples	64
Nashville—	
Tennessee, 2 samples	64
Quebec dolomite—	
Alabama, 4 samples	23
St. Louis—	
Alabama, 17 samples	23
Kentucky, 55 samples	40
Tennessee, 69 samples	64
Trenton and Hudson River—	
Alabama, 2 samples	23
Kentucky, 57 samples	40
Maryland, 93 samples	46
Ohio, 11 samples	59
Pennsylvania, 24 samples (*see* Tobacco land)	60
Tennessee, 10 samples	64
Virginia, 53 samples	66
Unclassified—	
California, 1 sample	28
Wisconsin, 2 samples	69
Total, 481 samples.	

Description.—The basis of this classification is geological. The limestone soils as a rule give rise to very productive agricultural lands, but this is not necessarily so. The origin of large masses of limestone has usually been ascribed to the remains of organic life, as is certainly the case in many coral limestones. There is no doubt that organic life has had much to do with many of these limestone areas, but Mr. Bailey Willis calls attention to other physical and chemical means of formation which have been rather too little considered, namely, that from evaporation from an inclosed sea and a chemical precipitation of lime and magnesia from ocean waters.

Whatever the origin, the beds of limestone are usually intermingled with beds of shale, showing that the conditions of deposition were not uniformly alike while the material was being deposited. Sometimes there is a sharp line between the limestone and the other material, but usually this is not the case, and there is a gradual transition from limestone to shale. Frequently the limestone is far from pure and contains fragments of quartz and other finer material.

The best known of the limestones, from an agricultural point of view, is the Trenton limestone, which gives rise under complete disintegration to the very fertile blue-grass soils of Kentucky and the fertile lands of the Cumberland Valley in Virginia, Maryland, and Pennsylvania. The Trenton limestone, as occurring in this area, is a compact blue limestone, usually very pure carbonate of lime with some magnesia. The rock frequently contains 90 per cent and occasionally as much as 99 per cent of carbonate of lime. This lime carbonate is relatively quite soluble in natural waters, especially where they are charged with carbonic acid. By the prolonged digestion and leaching with rain waters the carbonate of lime is almost completely removed, leaving the small percentage of impurities as a surface covering to the rock, which constitute the soils of the present time. Where there is but 1 per cent of impurities in the rock a vast amount of rock material must be dissolved and removed in solution in the formation of each foot in depth of soil. As the limestone is usually bounded on either side by areas of less soluble material, such as shale and sandstone, the solution of the rock mass and consequent lowering of the surface over the limestone area gives rise to valleys bounded on either side by sandstone or shale ridges as a characteristic physiographic feature of a country derived from a pure limestone. A fresh limestone from Virginia, described by Prof. George P. Merrill[1] and analyzed by Mr. George Steiger, contained 28.39 per cent of lime, 18.30 per cent of magnesia, and 41.85 per cent of carbon dioxide. The impurities amounted to 11.46 per cent. There was 7.37 per cent of silica, 1.92 per cent of aluminum, and 1.09 per cent of potash, the other impurities being in very small quantities. The residual clay from this limestone contained only 0.50 per cent of lime, 1.18 per cent of magnesia, and 0.38 per cent of carbonic acid, so that the original constituents were almost entirely removed. The silica in this residual material had

[1] Bul. 150, U. S. Geological Survey, 1898, pages 384, 385.

increased to 55.90 per cent, the alumina to 19.92 per cent, the potash to 4.79 per cent. These, being in a less soluble form than the carbonates of lime and magnesia, had remained as the principal constituents of the residual clay. Another analysis quoted by Mr. Russell[1] shows even more strikingly the process of soil formation from the disintegration and solution of the Trenton limestone.

Analysis of Trenton limestone and of the residual clay left by its decay.

Constituents.	Unaltered limestone.	Residual clay.
SiO_2	0.44	43.07
Al_2O_3	.42	25.07
Fe_2O_3		15.16
CaO	54.77	.63
MgO	Trace.	.03
K_2O	....	2.50
Na_2O	....	1.20
CO_2	42.72	.00
H_2O	1.08	12.98
Total	99.43	100.64

Over this area of the Trenton limestone, from which most of the samples of that formation have been derived, the covering of residual clay is from 1 to 6 feet deep. The soil proper is from 6 to 12 inches deep, resting on a stiff, reddish yellow or orange-colored clay, containing on an average about 30 per cent of clay, as shown by the mechanical analysis. Occasionally the soil contains fragments of limestone rock or of quartz. These soils as a rule are extremely fertile and very productive. They will stand a good deal of rough usage and of hard farming, but respond well to good treatment. On account of the great solubility of the carbonate of lime from which they are derived, they are frequently deficient in lime. It is no unusual thing to see the rocks brought up from just below the surface, burnt in kilns, and applied to the land as a top dressing. A limestone soil is not necessarily a calcareous soil, the name signifying merely the origin and not the composition of the soil.

Farther south, in Georgia and Alabama, the Trenton limestone has associated with it many veins of quartz rock and other impurities. In the disintegration of the limestone this quartz remains as fragments on the surface and distributed through the residual clay. Far from representing the fertile conditions of the Northern soils, the Trenton limestone in this locality is noted as being classed among the poorest soils. So with some of the other limestones. The amount of quartz and other impurities are so great that the resultant soils are stony and infertile, and the country is liable to be barren and unproductive.

LIVE-OAK LAND.

Locality: Page.

Mississippi, 2 samples 51

[1] Water Supply and Irrigation Papers, U. S. Geological Survey, No. 4, p. 64.

Description.—This is a soil classification of the Southern States based upon the native vegetation and refers to a strip of land near the ocean and gulf upon which the live oak is the principal native vegetation. Little can be said at present of the character of the soil or of any basis of classification, other than the mere occurrence of the live-oak trees. The soils, as a rule, are quite productive.

LOESS.

Localities:

Description.—This name is applied to a class of soils having very uniform texture and physical properties. Therefore, the basis of the classification is the physical property of the material.

The loess is characterized by containing upward of 60 per cent of silt, as shown by the chemical analysis. It is a very fine loamy soil, usually containing a high percentage of lime. In typical localities it is permeated by little tubes formed either by worms or by the roots of plants which have decayed. It is loamy and soft to work and yet it resists erosion to a remarkable degree. Perpendicular cliffs stand for long periods without much erosion or surface alteration. Nearly everywhere the loess is valued as a fertile and easily worked soil, responding readily to thorough cultivation. It is usually well drained, but in places it occurs as an impervious strata, having all the essential peculiarities of an impervious clay, which is extremely difficult to improve.

The origin of the loess is ascribed by different investigators to wind and water action. Probably each of these agents is responsible in certain localities. It is certain that the material has been sifted out, as in a mechanical analysis, and is made up of grains of nearly uniform size. Similar natural assortments of material occur in various places and of various-sized particles. Thus, the State of Nebraska is made up of several grades of material. The northern part of the State is covered by the sand hills, having uniformly coarse sandy soils. The southwestern part is covered by the plains marl, containing upward of 70 per cent of very fine sand. East of this is the loess, with 60 per cent of silt; while along the Missouri River the clay soils contain from 30 to 60 per cent of clay, as indicated by the mechanical analysis. The same assortment of material is found in many localities in the old glacial lake deposit of the Connecticut River and along the sluggish rivers of the South Atlantic coast. In South Carolina the rich rice lands, containing from 50 to 60 per cent of clay in the organic-free material, are found along

the sides of the rivers, where the waters have made broad terraces, in the dense vegetation of which the fine silts and clays have been deposited. Farther up the river the sand hills show where the coarser material has been deposited, while the Sea Islands, formed in front of the mouths of the rivers, contain upward of 70 or 80 per cent of medium sized sand grains, as shown by the mechanical analysis.

The loess is widely distributed in this country, especially along the Mississippi River, in Illinois, Indiana, Iowa, Missouri, and Nebraska. The soil collection contains samples from all of these localities and one sample from a typical locality in China which has been so widely studied and so often described.

I. C. Russell[1] describes the adobe of the extreme Western States as a loess. This description applies so well to the loess, and brings out so strongly the prominent features, that a summary is given here:

Distribution.—The area over which adobe forms a large part of the surface has not been accurately mapped, but enough is known to indicate that it is essentially coextensive with the more arid portions of this country. In a very general way it may be considered as being limited to the region in which the mean annual rainfall is less than 20 inches. It forms the surface over large portions of Colorado, New Mexico, western Texas, Arizona, southern California, Nevada, Utah, southern Oregon, southern Idaho, and Wyoming.

It occurs from near the sea level in Arizona, and even below sea level in southern California, up to an elevation of at least six or eight thousand feet along the eastern border of the Rocky Mountains and in the elevated valleys of New Mexico, Colorado, and Wyoming. It occupies depressions of all sizes, up to valleys having an area of hundreds of square miles.

Thickness.—The maximum thickness of the adobe is always difficult to determine, for the reason that it is still accumulating, and has not been sufficiently dissected by erosion to expose sections of any considerable depth. That it not infrequently has a depth of many hundreds of feet is apparent to one who traverses the valley in which it occurs. The profiles of very many of these valleys indicate that they have probably been filled to a depth of at least 2,000 or 3,000 feet. In the larger valleys there are rocky crests called "lost mountains," which project above the broad, level, desert surfaces, and are in reality the summits of precipitous mountains that have been almost completely buried beneath recent accumulations.

With these measurements before us, it does not seem that an estimate of 3,000 feet or more for the thickness of the superficial deposits in many of the valleys of the arid region is too great.

Physical characters.—Typical examples of adobe may be seen in thousands of places in the arid region, where sun-dried bricks are being made. In every Indian and Mexican village of Arizona and New Mexico there are excavations where material has been obtained for this purpose. Many times the bricks used in the construction of a building are made from the earth removed in digging its foundations. At these and many other localities, where the adobe is open to view, it appears as a fine-grained porous earth, varying in color through many shades of gray and yellow, which crumbles between the fingers, but separates most readily in a vertical direction. The coherency of the material is so great that vertical scarps will stand for many years without forming a noticeable talus slope. The sun-dried bricks made from it are more durable than the escarpments of natural earth and, when built into

[1] "Subaerial Deposits of the Arid Region of North America."—I. C. Russell. The Geological Magazine, Vol. VI, No. 7, July, 1889.

walls, are capable of standing the atmospheric conditions to which they are subjected for scores of years. There are buildings now in use in Santa Fe, N. Mex., built of sun-dried bricks, which, I have been assured on good authority, have been standing for more than a century.

The adobe used for brick making is usually light gray in color, but this is not always the case. It is frequently light yellow, and has varying tints, according to locality. Sometimes it has a reddish tint, caused by the prevailing color of the surrounding rocks from which it was in large part derived. The gray color of the adobe commonly seen in buildings is due in many, and probably in all cases, to an admixture of organic matter. Its characteristic color, when free from organic matter, is light yellow.

The principal characteristics observed were the extreme angularity of the particles composing the deposit, and the undecomposed condition of the various minerals entering into its composition. Adobe collected at typical localities is so fine in texture that no grit can be felt when it is rubbed between the fingers.

Chemical characters.—Analyses of several samples of adobe show that it not only has a varied composition, but differs in its chemical characteristics in different localities.

These analyses show that adobe is very distinct from residual clays, as is also proven by its appearance under the microscope. The analyses of residual clays from the southern Appalachian region [show them to be] composed essentially of ferruginous silicate of alumina and are remarkably free from substances which are readily soluble in ordinary surface waters. Adobe, on the other hand, has a complex composition and carries many substances which on exposure to percolating waters would be dissolved out. The difference is shown especially by the absence of calcium from residual clays and its abundance in adobe. Correlated with those differences in chemical composition are marked contrasts of color. The prevailing and characteristic color of residual clays is dark red; the adobe when not affected by organic matter is light yellow.

LONG-LEAF PINE FLATS.

Locality:

	Page.
Louisiana, 6 samples	41

Description.—Hilgard describes the pine flats of Louisiana as follows:[1]

The soil of the pine flats proper in this region is not materially different from that of the pine prairies, with which its herbaceous growth has much in common. It is a whitish or gray unretentive silt, with brown ferruginous or rusty spots, increasing downward, and indicating a lack of drainage. The cause is found, at a depth of 18 to 30 inches, in a compact whitish or bluish subsoil, full of bog-ore gravel, and consisting generally of siliceous silt compacted by clay, or sometimes of true clay, almost impervious to water, and of the consistence of putty, where it is brought up by the crawfish that commonly inhabit the lower tracts. The roots of the pines themselves remain above this water-sodden substratum, and hence hurricanes uproot them with great ease.

In the better-drained portions a very pale yellow silty loam is found in the place of the white "crawfishy" subsoil.

LONG-LEAF PINE HILLS.

Localities:

	Page.
Louisiana, 26 samples	41
Mississippi, 2 samples	51
Total, 28 samples.	

[1] Tenth Census, Vol. V, Cotton Production, Part I, Louisiana, p. 26.

Description.—Hilgard describes the pine hills of Louisiana as follows:[1]

A sandy, pale-yellow subsoil, covered a few inches deep by a tawny or gray, sometimes ashy, but more generally light, sandy surface soil, characterizes the long-leaf pine hills from Texas to Georgia. * * * The pervious soil and subsoil, often underlaid by loose, pervious sand at the depth of 1½ to 3 feet, prevents the formation of deep gullies or abrupt banks. Hence the dividing ridges are mostly broad and gently rolling plateaus, whose valleys are often without any definite water channels in their upper portions; wells in such regions sometimes finding only sand for 150 feet. * * *

The long-leaf pine forest is mostly open, so that a wagon can frequently traverse it with little more difficulty than the open prairie. The shade of the pine being very light, grasses and other plants requiring sunshine flourish underneath them, thus affording an excellent pasture, which fact has made stock-breeding the earliest industry of this region.

The uplands are usually exhausted by a few years' culture in corn or cotton, the crops being often fairly remunerative for the time, especially on tracts where a notable amount of oak and hickory mingles with the pine. In general, however, the bottoms of the larger streams are alone looked to for cotton production in the long-leaf pine hills. As in the prairies and flats, we find in them occasional oases of fertile land; usually ridges timbered with oak and some short-leaf pine.

LOWER PINE BELT.

Locality:

	Page.
South Carolina, 7 samples	61

Description.—Harry Hammond describes the lower pine belts of South Carolina as follows:[2]

The general appearance of the country is low and flat. The uniform level of the surface is scarcely broken anywhere, except here and there on the banks of the streams by the occurrence of slightly rolling lands. Its maximum elevation above tidewater is 134 feet. * * * It appears that the average slope is about 3½ feet per mile. * * * This fall would, with skillful engineering, be sufficient for thorough drainage as well as for irrigation. Left as it is, however, wholly to the operations of nature, this desirable object is far from being accomplished, and the broad but slow currents of the tortuous streams never free the swamps and lowlands of their superfluous water.

MAGNESIA SOIL.

Localities:

	Page.
Kansas, 1 sample (*see* Prairie)	38
Nebraska, 2 samples (*see* Prairie)	53
Total, 3 samples.	

Description.—The samples of magnesia soil in the collection were obtained by Professor Hay in Kansas, and little is known about the localities from which they are derived or the character of the soil.

MARLS.

Kinds and localities:

	Page.
Cretaceous—	
Maryland, 2 samples	47
Eocene—	
Maryland, 9 samples	47
Miocene—	
Maryland, 7 samples	47
Total, 18 samples.	

[1] Tenth Census, Vol. V, Cotton Production, Part I, Louisiana, pp. 26, 27.

[2] Tenth Census, Vol. VI, Cotton Production in South Carolina, Part II, 1880, p. 22.

Description.—The soil collection contains a number of samples of marls. The Miocene marls are all shell marls, more or less rich in carbonate of lime. Part of the Cretaceous and Eocene marls are "shell marls" also, but part of them are the greensand marls containing more or less glauconite or greensand as the characteristic feature.

MAUCH CHUNK.

Locality:

	Page.
Maryland, 4 samples (*see* Subcarboniferous)	47

Description.—The samples from this formation are from Maryland, and they are only interesting from the geological formation from which they have been derived. The area is very small and of little agricultural value.

MEDINA SANDSTONE.

Locality:

	Page.
Maryland, 4 samples	47

Description.—The samples of Medina sandstone are of interest mainly as coming from this geological formation. The Medina sandstone is a hard rock, which disintegrates very slowly and forms the capping of several mountains in western Maryland. The lands have little or no agricultural value.

MESA SOIL.

Localities:

	Page.
California, 2 samples (*see* Unclassified)	28
New Mexico, 2 samples	55
Total, 4 samples.	

Description.—The mesa or table-land is an interesting physiographic feature in the Pacific coast States. They are generally flat table-lands, elevated from 20 to 100 or more feet above the surrounding country. The soils may be of various kinds, the classification being physiographic. The term has no more agricultural meaning than the term "valley lands" would have.

MIOCENE.

Localities:

	Page.
District of Columbia, 2 samples (*see* Chesapeake)	32
Maryland, 94 samples (*see* Chesapeake)	44
New Jersey, 4 samples	55
Total, 100 samples.	

Description.—The classification here is geological, and the group may contain soils of all grades, including gravels, sands, and clays. The samples from Maryland, however, are particularly interesting, as they are derived from the diatomaceous horizon of the miocene. The diatomaceous earth occurs in very pure deposits in southern Maryland, in beds of great thickness. Lumps of this material will frequently float in water from the large amount of air contained in the spaces

between the particles. Under the microscope more than thirty species of diatoms have been found in the material, many of them of very beautiful forms. This diatomaceous earth is familiar in the commercial form of "silicon," used for polishing and cleaning silverwares and in several other forms for packing steam chests and boilers. It is used also as an absorbent for nitroglycerine in the manufacture of dynamite. On exposure to air in a moist condition this white diatomaceous earth quickly disintegrates into a fine yellow loam, forming the wheat and tobacco lands of southern Maryland.

MIXED LAND.

Locality:

	Page.
Florida, 10 samples	34

Description.—This is a light sandy area in Florida upon which the red oak and long-leaf pine grow together. In this respect it is intermediate between the pine lands and the hammock. There is no appreciable difference in the soil of any of these three formations, but a very decided difference in the character of the native vegetation and the agricultural value, the reason for which is not understood. The classification is thus based upon the botanical character of the native vegetation.

MOJAVE DESERT SOIL.

Locality:

	Page.
California, 9 samples	28

Description.—The surface of the Mojave Desert around Lancaster, Cal., where most of these samples were obtained, is covered with a rather coarse sand which is somewhat compact below the surface of the ground. This compact sand is frequently exposed as the loose surface sand is blown off. The samples were collected at least 20 miles from the mountains in the midst of a level plain. No rain had fallen for at least five and one-half months before the samples were taken. Contrary to expectation the soil at a depth of 12 to 18 inches below the surface was still moist. The amount of moisture in the subsoil was probably not sufficient to support any of our commercial crops, and what moisture there was was alkaline, but the fact of there being any moisture at all with no rain for so long a time is a subject for very careful investigation. There was a sparse native vegetation peculiar to the deserts of that locality. The surface wells over this part of the desert vary in depth from 6 to 30 feet, occasionally being 200 feet deep. On certain parts of the desert it is the common practice to dig water holes for stock from 6 to 10 feet deep, which quickly fill with water, affording a supply for stock. The water as a rule is strongly impregnated with alkali. There is an artesian belt under a portion of the desert. The distance to water varies with the nature of the underlying material, as in the humid portions of the country. The basis of this classification is thus physiographic, and the group may contain different kinds of soil.

MOLDING SAND.

Localities:

	Page.
Maryland, 1 sample (*see* Unclassified)	49
Pennsylvania, 2 samples (*see* Unclassified)	60
Total, 3 samples.	

Description.—This is a sand of medium-sized grains, which in a moist condition receives impressions and holds up well when molten metals are poured into the molds. Molding sand may be used a number of times, but finally it loses its powers of cohesion and becomes "dead." The reason for this is not understood, as there is no apparent change visible to the eye and it is only apparent to the workmen. The best grades of molding sands are found in few localities—one of the principal sources of supply for the Eastern States being near Albany, N. Y. The collection contains samples of both the good and the "dead" sand and offers an interesting field of investigation on some problems connected with the physical properties of soils. The basis of this classification is the commercial use to which it is adapted.

NASHVILLE LIMESTONE.

Locality:

	Page.
Tennessee, 2 samples	64

Description.—The Nashville limestone is similar to the Trenton limestone and gives rise to some of the most fertile agricultural lands in the blue-grass region of Tennessee. For a general discussion of the limestone soils, see Limestone.

ORANGE SAND.

Localities:

	Page.
Alabama, 54 samples (*see* Lafayette)	23
Louisiana, 8 samples (*see* Lafayette)	41
Tennessee, 10 samples (*see* Lafayette)	64
Total, 72 samples.	

Description.—The samples of the orange sand formation are sandy loams, easily worked, and very productive and durable when properly managed. They wash badly, however, when neglected. These soils are quite similar in texture to the loess, containing upward of 60 per cent of silt as shown by the mechanical analysis.

ORISKANY SANDSTONE.

Locality:

	Page.
Maryland, 12 samples	47

Description.—The Oriskany sandstone formation occurs in narrow belts in the mountains of western Maryland. The rock disintegrates with difficulty and usually forms a capping to the mountain ranges. It gives rather a coarse-grained sandy soil, usually containing many fragments of rock. The areas of this soil are small and of very little agricultural importance.

PERMIAN.

Locality:

	Page.
Texas, 2 samples	65

Description.—The samples of the Permian formation in the collection represent some of the best wheat lands of Texas.

PHILLITE.

Localities:

	Page.
Maryland, 55 samples	47
Pennsylvania, 2 samples (*see* Tobacco land)	60
Total, 57 samples.	

Description.—This is mainly a hydromica schist, occurring on the Piedmont plateau and found in large areas in Maryland, Pennsylvania, and Virginia. It forms some of the most fertile lands of the Piedmont area of these States. It is adapted to corn, wheat, and grass, and is a fair type of the most productive soils of the Eastern States for general agricultural purposes.

PIERRE SHALES.

Locality:

	Page.
Montana, 2 samples	52

Description.—The samples from this formation are from the Yellowstone Valley, Montana. The rocks bound the southern side of the Yellowstone Valley and give rise to the heavy type of clay and gumbo soil found in the valley. In many places in the valley this clay is mixed with or overlaid with sandy soils of the Fox Hill sandstones. The shales carry a quantity of "alkali" salts, mainly sodium sulphate and magnesium sulphate, together with large quantities of gypsum. The soils derived from these shales likewise contain considerable alkali. A full description of these soils is given in Bulletin No. 14 of this Division, "On the Investigation of the Alkali Soils of the Yellowstone Valley."

PINEAPPLE LAND.

Locality:

	Page.
Florida, 10 samples	34

Description.[1]—Pineapples are grown very extensively on the high pine land at Orlando, Winterhaven, and at many other places in the center of the peninsula, but along the east coast from Fort Pierce down to Lake Worth there is a narrow strip of country almost entirely devoted to the pineapple industry. The pineapple lands comprise here a narrow strip, hardly more than an eighth or a fourth of a mile wide, with the Indian River or the ocean on one side and the pine flats on the other, stretching out into the great savannas or everglades. The ridge has an average elevation of perhaps 15 or 20 feet. The growth is mainly scrub oak, spruce pine, and palmetto. Much of it is quite dense and the character of the growth makes it quite expensive to clear the land. The soil is a coarse sand, almost pure white and to all appearances as free from any trace of plant food as the cleanest glass sand. The subsoil is either a coarse white or yellow sand. The yellow sand is generally preferred, as it is considered rather stronger than the white. Nothing would seem

[1] Bull No. 13, Division of Soils, pages 16 and 17.

more unpromising to a Northern farmer than the white sand thrown out from a ditch or exposed in a railroad cut extending through these pineapple soils, upon which the pineapple industry is so profitable and the returns are so sure that the growers can not only afford enormous applications of fertilizers, but expend from $400 to $500 an acre in irrigation or in covering the fields with open lattice sheds. * * *

This land presents some very interesting problems to the student of the soil, as it appears to be lacking in every requisite of food and to have the physical conditions most unsuited to agricultural purposes. * * *

There is no more striking example of the adaptation of special soil conditions to particular crops than is afforded here, and the utilizing of conditions which could not possibly have been used for general agricultural purposes. If the whole country were looked over it would be hard to find a less promising soil than this, which, however, through a peculiar adaptation to a certain kind of plant has, when cleared and planted, a value ranging from $500 to $2,500 per acre and even more.

The months of March, April, and May constitute the dry season for that locality, and the two latter months are important in the pineapple industry, as that is the time when the apple is forming. Serious damage has often been done at this season by severe droughts, and to provide against this injury irrigation has been employed to quite a considerable extent. The usual method of irrigation is to produce a fine overhead spray with standpipes 3 or 4 feet high at intervals of from 15 to 20 feet each way. This method had not been altogether satisfactory, however, and lately the method of shading has come into considerable use. The roof of the open shed consists of 3-inch strips nailed to light framework, the strips being 3 inches apart, so that less than one-half as much sunlight falls upon the plants or the surface of the ground as would be received if the shed were not there. This tends to retard evaporation from the soil and from the plant. It is also very efficient in protecting the plants against frosts, and it is used for this purpose extensively in the northern part of the pineapple area.

The most favorable water content for these soils is from 3 to 4 per cent. The drought line is about 2 per cent.

PINE BARRENS.

Locality:

	Page.
Maryland, 15 samples (*see* Lafayette)	46

Description.—The soils are coarse sandy lands, covered with rather small growth of pine with considerable undergrowth. The lands have little agricultural value for any of our commercial crops.

PIPE CLAY.

Localities:

	Page.
Alabama, 1 sample (*see* Unclassified)	24
South Carolina, 2 samples (*see* Trap)	62
Virginia, 14 samples (*see* Barrens)	66
Total, 17 samples.	

Description.—This is a very impervious impure clay, found in a number of geological formations. Where reasonably pure and plastic it would be used for pottery. The term is confined to the eastern part of the country. It corresponds with the heavy adobe and gumbo soils of the West. In its agricultural sense it means any soil which is close and sticky when wet, nearly impervious to water, and which requires underdrainage for profitable cultivation. It may contain a large amount of clay, or it may be made up mainly of silt or even fine

sand, which sometimes possesses these impervious, plastic qualities. For further discussion of this subject see under the head of "Clays, pottery." The basis of this classification is the physical property of the material.

PLAINS MARL.

Localities:

	Page.
Colorado, 3 samples (*see* Prairie)	30
Kansas, 23 samples (*see* Prairie)	38
Nebraska, 15 samples (*see* Prairie)	53
Total, 41 samples.	

Description.—This is an interesting soil area, as it is one of the classes of sediments which have been assorted out into a nearly uniform size of grain by wind or moving water. It covers a large area in western Nebraska and Kansas. It is a very fine loam containing upwards of 70 per cent of very fine sand, as shown by the mechanical analysis. This is one grade coarser than the loess, which adjoins it upon the east. The soil usually contains rather a high percentage of carbonate of lime. It is easily worked and exceedingly fertile and productive when properly cultivated.

PLEISTOCENE (*see* TRUCK LAND).

Description.—The samples under this name, from New Jersey, represent merely this particular geologic age. The character of the samples may be quite different, as they include gravels, sands, and clays.

POCONO SANDSTONE.

Locality:

	Page.
Maryland, 5 samples (*see* Subcarboniferous)	47

Description.—This is a group of little agricultural importance, as the rock is not easily disintegrated and forms cappings of some of the mountains of western Maryland. The soils are usually coarse-grained sands, and have little agricultural value.

POCOSON REGION.

Locality:

	Page.
North Carolina, 8 samples	56

Description.—These soils cover a large area in eastern North Carolina. The soil is very deep, black, and rich looking, but the country is very level, low, and flat, with insufficient fall to give adequate surface drainage. The country was once drained with an extensive system of open ditches, but since the war these have been neglected and are no longer efficient. The lands need drainage, but this is difficult to provide on account of the topography of the country.

PONTOTOC RIDGE.

Locality:

	Page.
Mississippi, 2 samples	51

Description.—This is a geological classification adopted by the Mississippi survey. Little is known of the character of the soils, except as these have been described in Hilgard's report on the geology of Mississippi and in the Tenth Census.

POST-TERTIARY.

Locality:

	Page.
Kentucky, 26 samples	40

Description.—These are fertile tobacco lands in the western part of Kentucky, between the Tennessee and Mississippi rivers.

POTOMAC.

Localities:

	Page.
District of Columbia, 6 samples	32
Maryland, 13 samples	47
Total, 19 samples.	

Description.—The Potomac formation extends in a narrow belt from New Jersey southward, through the Atlantic coast States, along the fall line of the rivers. It belongs to the Lower Cretaceous. It is usually unproductive, and is made up of a succession of various colored clays, gravels, and sands. The samples in the collection are mainly from Maryland and represent the red and white clay features of the formation. These red clays contain from 30 to 50 per cent of clay, as shown by the mechanical analysis, and have about the same texture as the Trenton limestone soils, forming fertile lands of the Cumberland Valley in western Maryland. It is probable, however, that the structure is different as the Potomac clays are very impervious to water and the movement of water through them is so slow that plants may suffer where an analysis would show an abundant supply of moisture. The growth on these clay lands is mainly pine. The same class of vegetation and the same habits of growth are seen as prevail in the loose dry sands of the pine barrens. This offers an interesting subject for investigation in soil physics, as the infertility of these Potomac clays is unquestionably due to their physical properties and conditions.

POTTSVILLE.

Locality:

	Page.
Maryland, 8 samples	47

Description.—These samples are interesting merely as they represent this particular geological formation in Maryland. The area is small and the soils have little agricultural value.

POTSDAM SANDSTONE.

Locality:

	Page.
Pennsylvania, 1 sample	60

Description.—This sample merely represents this particular formation and little is known about the character of the soils.

PRAIRIE.

Localities:

Description.—This classification is based upon the botanical characteristics in the absence of trees. Prairies may be level or rolling and they may contain all kinds of soils of any geological formation. The reason for the absence of trees has been an interesting field of investigation, upon which much has been written in the past. The most plausible reason is the occurrence of forest fires which have annually swept over the country, destroying all trees and even the seeds of trees. Very ingenuous theories have been advanced, holding that the soil itself is not adapted to tree growth. This is hardly tenable, as the prairies contain soils of the most varied chemical composition and physical structure. There are large areas in Tennessee which have been particularly studied, which were formerly prairies, which are now covered with a luxuriant tree growth. Many successful attempts have been made at forest plantings on various prairies in the West, proving that the soil is not necessarily unsuited to tree growth. Still, such forests do not spread very rapidly, and it is noticeable that even along the wooded water courses the tree growth does not spread inland to any great distance from the rivers. The question is not satisfactorily settled and still offers an interesting field of speculation and investigation.

PROVISION LAND.

Locality:

Description.—On the sea islands off the coast of South Carolina the principal cotton lands are around the edges of the islands where the drainage is good. In the interior, with nearly the same character of soil, the drainage is not so good and water stands within a short distance of the surface. There is often a layer of bog iron ore within 2 or 3 feet of the surface, which is very impervious to water. These lands are not adapted to the sea island cotton, but they produce good

crops of corn and forage, and they are used for this purpose; hence their name. The soils are darker than the better-drained cotton lands, as would naturally be expected.

QUARTZITE.

Locality:

	Page.
Maryland, 2 samples	47

Description.—These samples are from a narrow ridge in central Maryland. The soils are of rather coarse-grained sand, covered with a growth of chestnut. They are of small extent and have little agricultural value. They stand out as a prominent feature of the country, both from the elevation of the ridges and the dense chestnut growth.

QUICKSAND.

Locality:

	Page.
Maryland, 1 sample (*see* Unclassified)	49

Description.—This group is interesting from the peculiar physical characteristics that are not very well understood. The name is often applied to layers of sand through which springs of water bubble up. This sand, being filled with a large volume of flowing water, is soft, easily caves in, and allows heavy objects to sink into it. The grains of quicksand are rather uniform in size and have rounded edges. Some authorities believe the peculiar properties to be due entirely to the rounded condition of the grains and the condition of saturation. The sample in the collection is from a small area in a spring. There are no samples representing the large dangerous areas occasionally found in this and foreign countries. These deposits are so mysterious and treacherous and the occasional accidents are so sudden, appalling, and tragic that they have often been described by novelists in the most graphic way.

The following, by Victor Hugo,[1] is one of the most remarkable and powerful descriptions of quicksand given in any literature, and shows very strikingly the popular conception of many treacherous areas:

> It sometimes happens, on certain coasts of Brittany or Scotland, that a man, traveler or fisherman, walking on the beach at low tide far from the bank, suddenly notices that for several minutes he has been walking with some difficulty. The strand beneath his feet is like pitch; his soles stick to it; it is sand no longer, it is glue. The beach is perfectly dry, but at every step he takes, as soon as he lifts his foot, the print which it leaves fills with water. The eye, however, has noticed no change; the immense strand is smooth and tranquil, all the sand has the same appearance, nothing distinguishes the surface which is solid from the surface which is no longer so; the joyous little crowd of sand fleas continues to leap tumultuously over the wayfarer's feet. The man pursues his way, goes forward, inclines toward the land, endeavors to get nearer the upland. He is not anxious. Anxious about what? Only he feels somehow as if the weight of his feet increased with every step which he takes. Suddenly he sinks in; he sinks in 2 or 3 inches. Decidedly he is not

[1] Les Miserables.

on the right road; he stops to take his bearings. All at once he looks at his feet; his feet have disappeared; the sand covers them. He draws his feet out of the sand; he will retrace his steps; he turns back, he sinks deeper in; the sand comes up to his ankle; he pulls himself out and throws himself to the left, the sand is half leg deep; he throws himself to the right, the sand comes up to his shins. Then he recognizes with unspeakable terror that he is caught in the quicksand and that he has beneath him the fearful medium in which man can no more walk than the fish can swim. He throws off his load if he has one, he lightens himself like a ship in distress; it is already too late, the sand is above his knees; he calls; he waves his hat or his handkerchief; the sand gains on him more and more. If the beach is deserted; if the land is too far off; if the sand bank is of too ill-repute; if there is no hero in sight, it is all over—he is condemned to enlizement; he is condemned to that appalling interment—long, infallible, implacable, impossible to slacken or to hasten; which endures for hours; which will not end; which seizes you erect, free, and in full health; which draws you by the feet; which, at every effort that you attempt, at every shout that you utter, drags you a little deeper; which appears to punish you for your resistance by a redoubling of its grasp; which sinks the man slowly into earth while it leaves him all the time to look at the horizon, the trees, the green fields, the smoke of the villages in the plain, the sails of the ships upon the sea, the birds flying and singing, the sunshine, the sky. Enlizement is the grave become a tide and rising from the depths of the earth toward a living man. Each minute is an inexorable enshroudress. The victim attempts to sit down, to lie down, to creep. Every movement he makes inters him. He straightens up; he sinks in. He feels that he is being swallowed up; he howls, implores, cries to the clouds, wrings his hands, despairs. Behold his waist—deep in the sand. The sand reaches his breast, he is now only a bust. He raises his arms, utters furious groans, clutches the beach with his nails, would hold by that straw, leans upon his elbows to pull himself out of this soft sheath, sobs frenziedly. The sand rises; the sand reaches his shoulders; the sand reaches his neck. The face alone is visible now. The mouth cries; the sand fills in—silence. The eyes still gaze; the sand shuts them—night. Then the forehead decreases, a little hair flutters above the sand, a hand protrudes—comes through the surface of the beach—moves and shakes and disappears. Sinister effacement of a man.

The depth of these areas has never been sounded nor the conditions and properties sufficiently studied. It offers an interesting line of investigation to the soil physicist. It is the extreme opposite of pipe clay in physical properties, and, while seldom encountered in such areas as described by Victor Hugo, is frequently of considerable economic importance in digging wells and excavating for the foundation of buildings.

QUEBEC DOLOMITE.

Locality:

	Page.
Alabama, 4 samples	23

Description.—These soils are rather heavy clay, usually containing a large amount of chert and fragments of undecomposed rock.

RED CHAPARRAL.

Locality:

	Page.
California, 3 samples (*see* Unclassified)	29

Description.[1]—On the mountain slopes of the Santa Cruz range the lands are largely covered with "chaparral" or scrub growth. A sample of chaparral soil from Saratoga, Cal., is a dark reddish-brown color when dry, forming hard lumps;

[1] Tenth Census, Vol. VI, Part II, Cotton Production in California, 1880, page 51.

dry umber color when wet, softening easily; quite stiff in working, but assuming good tilth when taken at the right stage of moisture. Below 12 inches lies a gravelly, rather stiff clay subsoil of an orange tint. More or less fragments of the country rock (a fine, soft, calcareous sandstone or shale) are contained in both soil and subsoil.

RED LAND.

Localities:

	Page.
Alabama, 17 samples (*see* St. Louis limestone)	23
Florida, 11 samples (*see* Lafayette)	34
South Carolina, 13 samples (*see* Red Hill formation)	62
Total, 41 samples.	

Description.—The "red lands" of South Carolina adjoin the Sand Hills on one side and the upper pine belt on the other. There is a large area of these lands around Aiken and another one at Wedgefield. The soil is a red loam and the subsoil is a rather stiff red clay, which, however, is well drained. The lands are very well adapted to cotton and corn. They are easily cultivated and respond readily to fertilizers and thorough cultivation. They are easily run down, however, if they are neglected or abused. The soils of this class in Alabama and Florida are similar to those of South Carolina.

RED RIVER VALLEY (*see* LACUSTRINE and JAMESTOWN VALLEY).

Localities:

	Page.
Minnesota, 12 samples	51
North Dakota, 17 samples (*see* Lacustrine)	58
Total, 29 samples.	

RICE LAND.

Localities:

	Page.
Florida, 18 samples (*see* Muck land)	34
Louisiana, 77 samples	42
North Carolina, 7 samples (*see* Alluvial soil)	56
South Carolina, 7 samples (*see* Alluvial soil)	61
Total, 109 samples.	

Description.—The soils of the rice lands are very rich alluvial deposits in the Southern States brought down from the upcountry and deposited along the low-level terraces at high tide or when the water overflows its banks during the time of freshets. The unconsolidated material of the coastal plains is very much broader at the south, and the rivers having cut down into this are broad and sluggish. The upland soils in the South, as a rule, wash much more readily than soils of the Northern States, and the sediments carried by these sluggish streams contain the most fertile portion of the soil of the upcountry. The soil of the rice lands is a very strong and plastic clay, containing from 20 to 50 per cent of organic matter so thoroughly disintegrated in the best rice lands as to have lost all of its original structure and exists as an amorphous humus-like mass. In its usual moist or wet condition the soil can be cut with ease, like butter, and worked like putty. A stick can be pushed down into it to a very considerable depth. Cultivation is usually done by oxen, instead of mules or horses, as they are

less likely to mire in this soft, sticky material. A description of these soils, with their mechanical analysis and methods of cultivation, is contained in Report No. 6 of the Miscellaneous Series of the Division of Statistics of this Department, on "Rice, its Cultivation, Production, and Distribution in the United States and Foreign Countries."

SALINA SANDSTONE.

Locality:

	Page.
Maryland, 1 sample	47

Description.—This is a small area, in narrow belts of red clay loam, found in the mountains of western Maryland. The area represented by the samples is so small that it is of little or no agricultural importance, and the samples are interesting merely as they represent this geological formation.

SALT-GRASS LAND.

Localities:

	Page.
California, 1 sample (*see* Unclassified)	29
Kansas, 2 samples (*see* Prairie)	38
Total, 3 samples.	

Description.—Over many of the western plains there are frequent small depressions where soluble salts, or so-called "alkali salts," have accumulated to such an extent that only the salt grasses and saltbushes grow under natural conditions. There is usually not sufficient alkali to prevent cultivation, and the lands are easily reclaimed if properly treated. The soils may be of any texture, from sand to compact clay, but they are generally underlaid by more or less impervious material which interferes with the proper drainage.

SAND HILLS.

Localities:

	Page.
Kansas, 6 samples	39
South Carolina, 12 samples	62
Total, 18 samples.	

Description.—The Sand Hills proper include both water deposits and wind deposits or sand dunes. Although usually of relatively small area, they form distinct physiographic features of long, narrow ridges more or less elevated above the surrounding country. The material in the collection has been sorted over by moving water, which has removed the finer portions and deposited them elsewhere. After this mechanical separation the wind frequently piles up the deposits in dunes, which are liable to shift around unless protected by a close mat of vegetation. Some of these deposits of sand show a remarkable power of maintaining capillary water within a few inches of the loose, dry surface. Sometimes the Sand Hills are covered with a sparse growth of pines and scrub oaks; at other times they are covered with grasses, and there are times, again, when they are quite bare of vegetation. Often, in the val-

leys between the ridges, the soil has sufficient moisture for vegetation. Such valley areas are adapted to vegetables and quick-growing spring crops, but as a rule the soils at present have little agricultural value for any of our staple crops. Along the coast they are often a serious menace to the adjacent lands, as they are liable to shift about and cover forests and arable lands, often encroaching rapidly upon fertile tracts. This has offered serious problems in many places to find sand-binding grasses or forest trees which will protect adjacent lands from the devastation caused by the shifting sands. At other places, particularly in inland situations, the boundaries are fixed and the areas are not subject to change.

SANDSTONE.

Locality:

	Page.
West Virginia, 3 samples	69

Description.—The nature of this sandstone is not known, and the samples represent a small area of little agricultural importance.

SEA-ISLAND-COTTON SOIL.

Locality:

	Page.
South Carolina, 23 samples	62

Description.—The sea islands along the coast of South Carolina are made up of nearly uniform-sized grains of sand, containing upwards of 80 per cent of fine sand, as shown by the mechanical analysis. These sands have been sifted out of the rivers and this grade of material is deposited just off the coast in sand bars, which have gradually been elevated or built up into islands, elevated about 6 feet, on the average, above the present sea level. The interior of the islands is usually poorly drained, and frequently underlaid with bog iron ore. These interior lands are not well adapted to cotton, but are well adapted to corn and forage plants and are used for this purpose; hence they are frequently known as "provision lands." The best cotton lands are around the edges of the islands, where the soils are dry and the drainage is good. There are several grades of soils recognized by the planters, which differ slightly in their physical texture. These are distinguished as sandy lands, gravelly lands, and loams. The differences are very slight and only appreciable to a careful observer who is thoroughly familiar with the soils. As standing water is found from 2 to 6 feet below the surface, a peculiar system of cultivation is practiced, in which salt mud and reeds are put in the bottom of the furrows, upon which a bed 2 or 3 feet high is thrown up, as in the old Roman method of cultivation before underdrainage was practiced. This method keeps the roots of the cotton plants from going down into the moist soil and insures a dry bed, which hastens the maturity of the slow-growing variety of long-staple cotton peculiar to this locality. Within recent years tile drainage has been introduced, but nearly the same methods of cultivation

are still practiced, as the planters dread any radical change in methods which have been used for many years and upon which the success of the fine staple formerly depended.

SEDENTARY SOIL.

Locality:

	Page.
Kansas, 4 samples	39

Description.—This is a classification adopted by Prof. Robert Hay in the geological survey of Kansas, and little is known about the character of the soils.

SERPENTINE.

Locality:

	Page.
Maryland, 10 samples	47
South Carolina, 4 samples (*see* Talc)	62
Total, 14 samples.	

Description.—There are two distinct types of soil in the serpentine area. As a rule the soils wash badly, leaving but little covering over the finely disintegrated rock. For this reason the areas are usually quite barren. This condition is characteristic of several areas in Maryland from which the samples have been derived. Recent investigations by the Division have shown, however, that there are comparatively small areas in the northern part of Cecil County, Md., in which the disintegration and decomposition have been more thorough, and the thoroughly decomposed and disintegrated material has accumulated to a considerable depth, giving a highly colored red clay, very strong and quite productive. None of these samples of fertile serpentine soil are included in this catalogue. The samples of talc soil from South Carolina, belonging to this group, give a light, fine-grained loam adapted to bright tobacco, but having little value for the other staple crops.

SHALES.

Locality:

	Page.
New York, 4 samples	56

Description.—The samples from New York represent a large area upon which a particularly fine quality of rye is produced. The soils are filled with small fragments of undecomposed shale. Little more is known of their agricultural value.

SHORT-LEAF PINE UPLANDS.

Locality:

	Page.
Mississippi, 2 samples	51

Description.—The soil of the short-leaf pine uplands is somewhat richer than the long-leaf pine hills, but otherwise the two are almost identical.

SILT (FROM IRRIGATION DITCHES).

Localities:

	Page.
Arizona, 1 sample	25
Kansas, 1 sample	39
Texas, 2 samples	65
Total, 4 samples.	

Description.—These samples of silt are from irrigation ditches, where they are valued for their fertilizing properties when deposited on the land. They are also valued for their cementing effect on the ditches themselves, in which they prevent, to a very large extent, the loss by seepage of water from the canals.

SILURIAN, UPPER.

Locality:

	Page.
Kentucky, 2 samples	40

Description.—The samples of Upper Silurian represent some of the fertile wheat, corn, and grass lands of Kentucky.

SNOW DUST (*see* WIND-BLOWN DUST).

Description.—These samples were sent in by the observers of the Weather Bureau, and a statement was published in the Monthly Weather Review of January, 1895, of which the following is a summary:

On the nights of January 11 and 12, and along the advancing edge of a cold wave, there fell throughout a large part of Indiana and Kentucky a shower of dust in connection with snow. It does not appear that this dust was the nucleus of snowflakes, but was intermingled in the air with the snow or fell with the wind that preceded the second snow fall. * * *

The soil is made up largely of silt, mixed with organic matter. A number of fresh-water algæ could be distinguished, though they had evidently been dead and dried for a long time. Two of these, viz, Coleochæte and Desmid, indicate that the "dirt" was the bottom of some shallow lake, pond, or marsh that had dried up. These two algæ usually grow in water that is comparatively fresh, and which seldom dries up completely. A fungus was found which occurs very commonly on dead plant tissue. The cells of decayed grasses and sclerotic cells from the decayed fruits of grasses occur in the débris. Animal and plant hairs are common; also fibers of grasses, shreds of woody tissue of shrub or tree. Masses of mixed and interlaced fibers looking like paper are occasionally seen. Everything indicates that the "dirt" came from the bottom of some dried-up lake, pond, marsh, or some river bottom. It is light enough to be carried some distance by a strong wind. * * *

All the samples show that the dust was lifted by some windstorm, spread out in an upper-air stratum, and precipitated. * * *

Prof. H. L. Bruner, of Irvington, Ind., states that in general a layer of snow about one-fourth inch deep was colored distinctly brown by the dust. It fell on a bed of snow several inches deep and was thus protected from contamination by surface dust.

The mechanical analysis of several of the samples showed the material to be similar in texture to the loess, as it was made up of 50 or 60 per cent of silt. This is probably an instance of the characteristic formation of loess from aerial forces which are constantly going on in that locality, made apparent by the covering of snow which received the deposit.

SPRUCE-PINE SCRUB.

Locality:

	Page.
Florida, 6 samples	34

Description.—This is a sandy soil from Florida upon which the characteristic growth is scrub, containing a considerable growth of spruce

pine. There is no apparent difference in the soil between this and the hammock and high pine lands of this locality, but the botanical features are very characteristic and interesting.

ST. LOUIS LIMESTONE.

Localities:

	Page.
Alabama, 17 samples	23
Kentucky, 55 samples	40
Tennessee, 69 samples	64
Total, 141 samples.	

Description.—This formation forms one of the important soil areas of Kentucky and Tennessee, giving rise to a strong clay adapted to grass, wheat, and corn. It is similar to the Trenton limestone soils. For general discussion of limestone soils, see under the appropriate head of limestone.

SUBCARBONIFEROUS.

Kinds and localities:

	Page.
Keokuk—	
Kentucky, 2 samples	39
Tennessee, 2 samples	65
St. Louis group—	
Kentucky, 55 samples	40
Tennessee, 69 samples	65
Unclassified—	
Illinois, 4 samples	36
Maryland, 15 samples	47
Tennessee, 13 samples	65
Waverly sandstone—	
Kentucky, 2 samples	40
Total, 162 samples.	

Description.—This is a general geological subdivision, including several limestones and one sandstone area, which are described under their several names.

SUGAR-CANE LAND.

Localities:

	Page.
Florida, 18 samples (*see* Muck land)	32
Louisiana, 157 samples	42
Mexico, 6 samples (*see* Tobacco land)	50
Total, 181 samples.	

Description.—These are rich alluvial deposits in the Southern States, containing a high percentage of organic matter and adapted particularly to sugar cane and rice. The soils are very deep and rich; many of them are still subject to overflow unless protected by dikes along the river banks.

TALC.

Locality:

	Page.
South Carolina, 4 samples	62

Description.—There is a large area of serpentine in South Carolina upon which a very pure talc is found, which has been mined to a con-

siderable extent. The soils are light yellow and rather fine and powdery in texture. They are adapted to bright-yellow tobacco, but as a rule are thin and are not of very great agricultural importance.

TERTIARY.

Locality:

	Page.
Nebraska, 44 samples (*see* Prairie)	53

Description.—These samples merely represent this geological age and have not been subdivided. They may contain samples of very different texture, including gravels, sands, and clays. The individual samples are all described in the collection, but no general description can be given.

TOBACCO LAND.

Kinds and localities:

	Page.
Bright yellow (cigarette)—	
Louisiana, 2 samples	42
North Carolina, 39 samples	56
South Carolina, 2 samples	62
Tennessee, 3 samples	65
Virginia, 70 samples	67
West Virginia, 2 samples	69
Cigar—	
California, 2 samples	28
Connecticut, 21 samples	30
Cuba, 16 samples	31
Florida, 101 samples	34
Massachusetts, 22 samples	50
Mexico, 6 samples	50
Ohio, 21 samples	59
New York, 20 samples	56
Pennsylvania, 33 samples	60
Sumatra, 12 samples	63
Texas, 6 samples	65
Wisconsin, 18 samples	69
Export and manufacturing—	
Kentucky, 111 samples	40
Maryland, 118 samples	47
Tennessee, 89 samples	65
Virginia, 32 samples	67
Perique—	
Louisiana, 10 samples	42
Sun-cured—	
Virginia, 14 samples	67
White Burley—	
Kentucky, 57 samples	40
Ohio, 11 samples	59
Tennessee, 12 samples	65
Total, 850 samples.	

Description.—This embraces all types of tobacco lands upon which the different commercial types and grades of tobacco are produced. A description of these soils is given in Bulletin No. 11 of this Division, to which reference is made of more detailed description than can be

given here. The bright yellow cigarette tobaccos are grown upon a light sandy soil in Virginia, North and South Carolina, East Tennessee, and to a small extent in West Virginia and some of the more southern States. The character of the soil is quite uniform. Of the cigar tobaccos, the fillers are grown in the heavy clay soils of Pennsylvania and Ohio; the binders—that is, the second grade of wrappers—are produced in Connecticut, New York, and Wisconsin, while the finest types of wrappers, supplying the present market demands, are produced on the light sandy soils of the Connecticut Valley as well as in New York and Wisconsin. The southern localities, Florida and Texas, have light sandy soils, preferably with clay subsoil, upon which the finest types of Sumatra wrapper and Cuban filler are produced. The export and manufacturing types of tobacco are produced on the heavy clay soils of Virginia and North Carolina and on the silt soils of Tennessee and Kentucky, with smaller areas in the adjoining States. The Perique tobacco is produced mainly in two or three of the southern parishes of Louisiana on a rather light alluvial soil. The peculiarity of this tobacco depends mainly upon the peculiar method of curing used by the Acadians of that locality. Little is known of the characteristic soil upon which the sun-cured tobacco of Virginia is produced. The White Burley tobacco is confined almost exclusively at present to the Trenton limestone strong red clay soils of central Kentucky and southern Ohio.

TRANSITION-GRAYWACKE.

Locality:

	Page.
Rhode Island, 2 samples	60

Description.—The graywackes from Wisconsin are thus described by W. S. Bayley,[1] and the description applies equally well to the soils from Rhode Island:

> The graywackes differ from the sandstones in composition. Whereas the latter consist essentially of quartz grains (or of quartz and feldspar) cemented by quartzitic, calcareous, or other cement, simple in composition, the graywackes contain grains of many different minerals and small fragments of rocks, united by a cement of the composition from many slates. In the formation of the sandstones the rocks from which the sands were derived were broken down into their constituent mineral components, and these were sorted by the waters in which they were deposited. On the other hand, the rocks from whose detritus the graywackes were made were not so completely disintegrated. The sands contained not only quartz and other mineral grains, but also little particles of rock, all so intermingled that we can not believe that much sorting took place. When rock particles are not to be found in the graywackes, the distinction between these rocks and the sandstones must rest upon the cementing material, which in the former is dark in color and contains much chlorite and some mica.

Little is known of the character of the soils resulting from the disintegration and decomposition of the graywackes.

[1] Bul. 150, U. S. Geological Survey, 1898, page 84.

TRAP.

Locality:

	Page.
South Carolina, 5 samples	62

Description.—The trap soils of South Carolina cover a rather small area and are not of much agricultural importance. The soils as a rule are clay loam, often containing rounded fragments of gravel highly colored with iron. Larger bowlders, known as "nigger heads," are usually seen over the surface. The subsoil is frequently a pipe clay, providing very poor drainage. The lands are liable to be wet and sticky for a long time after rains, and water is frequently found at a short depth below the surface and oozes out in springs, which give the soil almost the character of an upland marsh. With underdrainage and thorough cultivation the lands may be made fairly productive. Several of these samples could be classed as pipe clay.

TRENTON AND HUDSON RIVER LIMESTONE.

Localities:

	Page.
Alabama, 2 samples	23
Kentucky, 57 samples	40
Maryland, 93 samples	46
Ohio, 11 samples	59
Pennsylvania, 24 samples	60
Tennessee, 10 samples	64
Virginia, 53 samples	66
Total, 250 samples.	

Description.—The soils from these two formations, which can hardly be distinguished geologically, are quite similar in their agricultural value. They are the most important types of limestone, giving the highest type of agricultural land in the northern areas; but, being filled with chert in the Southern States, these soils are very infertile. These lands have been described in detail under the head of limestone.

TRIASSIC RED SANDSTONE.

Localities:

	Page.
Connecticut, 7 samples	30
Maryland, 15 samples	47
Total, 22 samples.	

Description.—The Triassic red sandstone disintegrates and decomposes very thoroughly, forming a heavy clay soil of a characteristic Indian-red color. In the southern extension of the area in Virginia the soils are quite stony from fragments of the rock. These southern lands have not been very productive. In the areas in Maryland, Pennsylvania, and New Jersey, however, the soils have less rock and form very fertile agricultural lands. In Maryland they are adjacent to the Trenton limestone soils, and in favorable seasons they are considered just as valuable for wheat, corn, and grass. They are not quite so safe or certain, and crops suffer from extremes of drought or wet weather more than on the limestone. The northern extension of the area in New Jersey is extremely fertile and productive.

TRUCK LAND (MAINLY COLUMBIA).

Localities:

Description.—The truck lands of the Atlantic Coast States, from which most of the samples in the collection have been obtained, occur as a narrow belt bordering the coast, bays, and rivers. This is mainly Columbia, and the sand is uniform in texture. The deposit varies from 12 inches to many feet in thickness. It is desirable to have a loam or clay subsoil at a depth of from 18 to 24 inches, as the soils are stronger, more durable, and rather more productive. These soils are valued chiefly because the spring vegetables mature so early that there is no local competition from the heavier soils of the locality. This subject has been discussed in great detail in various bulletins of this Division and in publications of the Maryland Experiment Station.

TULARE PLAINS.

Locality:

Description.—This group contains a number of samples of the characteristic soils around Tulare, Cal., many of them being alkali soils collected during the investigation of this subject. Some of the interesting features of these soils were pointed out in a paper, entitled "Some Interesting Soil Problems," published in Yearbook, United States Department of Agriculture, 1897.

UNCLASSIFIED.

Localities:

Localities—Continued.

Description.—This group contains samples from nearly all the States which, by reason of the small areas represented or the exceptional or peculiar characteristics of the samples, or because of an uncertainty as to their geological origin and an absence of any local designation, have not been grouped under any special class. Much of this material is valuable for the study of the chemical and physical properties of soils, and the individual samples are all fully described.

UPPER COAL MEASURES.

Locality:

Description.—The basis for this classification is purely geological, and the group may contain soils of different physical characteristics, including gravels, sands, and clays.

UPPER PINE BELT.

Locality:

Description.—The upper pine belt in South Carolina, from which these samples were derived, is a rather broad strip crossing the State, and given up mainly to pine forests. The soils are generally thin and rather poor. They are better drained than the lower pine belt, but the country is sparsely settled and very little of the land is actually under cultivation.

VALLEY LAND.

Locality:

Description.—These samples from Utah are from Utah County, and represent the lands in the vicinity of Salt Lake City.

VINEYARD SOIL.

Locality:

Description.—The samples under this group are from an important grape district in Geisenheim, Germany. This is described in a previous section under Germany.

VOLCANIC ASH.

Localities:

Description.—Volcanic dust is thus described by J. P. Iddings:[1]

This fine dust forms a deposit about 20 feet thick within Neocene lake beds of the Gallatin Valley, Montana, where it has been studied by A. C. Peal. The major part of these lake beds consists of volcanic dust presumably brought into the lake basins by waters from the neighboring slopes, where it has been deposited by the wind. The purer material occurring in these beds is considered to have been deposited directly from the air. It occurs in beds 2 to 5 feet thick, separated by thin calcareous layers, the thickness of the whole being 20 feet. When examined with a microscope it is seen to be made up of minute fragments of colorless glass, whose angular shapes in some instances and thread-like form in others, together with the presence of air pores, which are spherical, elliptical, and tubular, indicate plainly that the fragments are broken pumice. * * * A very small percentage of the fragments are pieces of crystals, and these appear to be feldspar, hornblende, pyroxene, and possibly some quartz. This small percentage of crystals, as compared with glass, may be due to the original paucity of crystals in the magma exploded in the dust, or it may be the result of a partial separation of the material during its transportation through the air, by which means the denser and more compact particles settled nearer the vent from which the eruption took place than the lighter and more attenuated ones. Hence, it can not be assumed that the material found in this deposit necessarily represents the composition of the lava before explosion. The glass itself is absolutely free from microlites, and is perfectly colorless in the thin bits forming the dust.

These soils are usually rich in potash. They apparently disintegrate rapidly upon exposure to air, to a light-colored, light-textured loam, which is quite productive.

WAVERLY SANDSTONE.

Locality:

Description.—This is one of the export tobacco lands of Kentucky, adapted to tobacco, corn, wheat, and grass.

WHEAT LAND.

Localities:

[1] Bulletin No. 150, Educational Series of Rock Specimens Collected and Distributed by the U. S. Geological Survey, page 146.

Localities—Continued.

	Page.
Illinois, 63 samples	36
Iowa, 2 samples	37
Kentucky, 160 samples	40
Maryland, 580 samples	49
Minnesota, 23 samples	51
North Dakota, 53 samples	58
Ohio, 49 samples	59
Pennsylvania, 26 samples	60
Russia, 7 samples (*see* Chernozem)	61
South Carolina, 11 samples	62
South Dakota, 11 samples (*see* Prairie)	63
Tennessee, 93 samples	65
Texas, 2 samples (*see* Permian)	65
Virginia, 99 samples	68
Washington, 29 samples (*see* Basalt)	68
Wisconsin, 18 samples (*see* Tobacco land)	69
Total, 1,298 samples.	

Description.—This group contains all samples upon which wheat is a staple and characteristic crop. It contains samples from a great many geological formations. It is the basis of an extensive collection of wheat soils which it is proposed to study.

WHITE-OAK LAND.

Locality:

	Page.
Maryland, 8 samples (*see* Wheat land)	49

Description.—This is a small and relatively unimportant group, occasionally met with, and locally known as white-oak land from the character of the native forest growth. As seen on the Eastern Shore of Maryland, it occurs in small areas. There appears to be no difference in the texture between this and surrounding lands, but the subsoil has a different structure and is nearly impervious to water. It could almost be classed as pipeclay, although it has not a large percentage of true clay, as shown by the mechanical analysis. The soil is generally unproductive, but may be reclaimed by underdrainage and proper methods of cultivation. It is believed that this condition can be imparted to certain soils through abuse and improper methods of cultivation. The soil is usually made up largely of silt, and has the texture of loess.

WIND-BLOWN DUST (*see* SNOW DUST).

Localities:

	Page.
Indiana, 2 samples	37
Nebraska, 3 samples	54
Total, 5 samples.	

WIRE-GRASS SOIL.

Locality:

	Page.
California, 1 sample (*see* Tulare plains)	28

Description.—These soils occur in small areas in the Western plains and in California, and are characterized by the native growth of wire-grass. Little is known about the character which causes this peculiar growth.